Navy Footprint Consolidation Analysis:
Baseline Perspectives

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Photo credit line: 120118-N-MG658-139 Arlington, Virginia (Jan. 18, 2012). Washington Headquarters Services in coordination with the Department of the Navy oversees a cornerstone removal, representing the upcoming demolition of the entire Navy Annex building. The land where the historical building is located will be used for a proposed heritage center and black history museum along with additional space for Arlington National Cemetery. (U.S. Navy photo by Mass Communication Specialist 2nd Class Todd Frantom/Released)

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Summary

There are insufficient resources in the current Navy fiscal environment to fund both the priority operational requirements and to fully sustain or recapitalize the shore infrastructure footprint. Future budget projections indicate that this situation will be pressurized even further than it already is. This analysis is needed to better inform the Navy about the current status of the shore infrastructure inventory and nature of the shore requirement determination process.

The Navy has recently instituted a new footprint offset policy requirement and a footprint consolidation initiative in order to restrain footprint growth. In addition to this, the requirement setting process for establishing and justifying the footprint size needs greater scrutiny. In some cases, historical reductions in shore infrastructure facility category code inventories closely match force structure adjustments; however, in other cases, the inventories have actually grown even though force structure has declined.

The Office of the Chief of Naval Operations (OPNAV) Warfighting Support Branch Head (N814) asked CNA to analyze the Navy's shore infrastructure requirements setting process, recent historical inventory trends, and current inventory capacity in light of Navy force structure changes. It is hoped that CNA's analysis of the requirements process will identify process weaknesses that result in inventory data inaccuracies, inconsistencies, and variations.

Our goal is to determine, through requirements setting process examination, historical inventory trend analysis, and current shore inventory deficit and available capacity[1] analysis, those areas that pro-

1. Deficit capacity is the difference between current assets and requirements when asset quantity is less than requirement, and available capacity is the difference when the asset quantity is greater than the requirement.

vide the best opportunities for further analysis of shore footprint consolidation and reduction. N814 asked us to recommend possible actions that the Navy could consider to assist in implementation of consolidation/reduction opportunities and capture of potential savings.

We met with personnel at Naval Facilities Engineering Command (NAVFAC) headquarters as well as field planning personnel to determine the processes and controls used to identify, validate, enter, maintain, and update the data in the inventory database. We used process improvement analysis techniques to develop an annotated process map with potential failure effect nodes.

This map of the Navy's shore requirements process highlights five different process risk areas that allow inconsistent, inaccurate, and erroneous information to be entered into the shore requirements planning module. The net result of these vulnerabilities is that the current basic facility requirements (BFR) process does not identify the minimum shore facility requirements for the Navy.

The five risk areas we identified were (1) lack of policy guidance for facility planning, (2) base loading personnel and unit assignment uncertainties, (3) facilities sizing standards development without cost impact analysis, (4) local changes to facility size standards without sufficient oversight, and (5) BFR data loaded directly into the Internet Navy Facility Asset Data Store (iNFADS) by installations/regions.

We found that the fiscal year (FY) 2011 end-of-year inventory consisted of 116,189 facilities, covering 771 million square feet equivalent (SFE) of area and valued at $207 billion. In analyzing the shore capability areas (SCAs), we determined that the inventory capacity is split between fleet operations (18 percent), fleet support (26 percent), and shore support (56 percent). The average facility size is 6,636 SFE and the average facility cost is $1.8 million. We noted that 63 percent of the facilities are buildings, 29 percent are structures, and 8 percent are utilities. The inventory is supported by different funding sources with the majority of direct funding supported by operations and maintenance, Navy and Navy Reserve (O&M,N/R) (53 percent). We focused on that part of the inventory for our trend analysis since the balance of the inventory is indirectly supported. This portion of the

inventory has 47,567 facilities, covering 406 million SFE of area and valued at $109 billion. The average facility size is 8,539 SFE and is valued at $2.3 million.

Our 10-year trend analysis showed that the number of facilities has remained relatively constant and the total area in SFE has declined by an average of 1.4 percent each year. However, the value in constant FY 2011 dollars has grown by an average of 2.3 percent each year. We also noted that facilities measured in square feet (SF) reflect a growth in cost per SF that is almost double that of the rest of the inventory (4.5 percent). The major capability growth areas were expeditionary operations at 8.7 percent each year and training support at 2.7 percent. The type of facilities that grew the most were land operational facilities at 4.6 percent and administrative offices at 3.7 percent. Over the same period, the fleet size declined by 53 ships (16 percent); personnel numbers also declined by 14 percent. However, civilian personnel numbers actually increased by 8 percent over the same period. There was a large difference between shore (4 percent) and afloat (32 percent) active duty reductions. This resulted in a reduction of 8 points in the afloat to shore active duty ratio from 37 percent to 29 percent.

We completed the analysis by developing a shore capacity analysis, which identified the current deficit and available quantities by both SFE area and a FY 2011 plant replacement value (PRV). We analyzed the available inventory by SCA, major facility category code number (CCN) group, and installation to determine the location of the available capacity. We used established Navy strategic support index (SSI) ratings to select the less mission critical available amounts. We then used recent Navy demolition project experience to develop an average Navy-wide cost of demolition per SFE. We used this threshold to select those CCNs where the PRV per SFE was greater than the estimated demolition cost per SFE. This provided us with a list of capacity areas that are the least mission critical and most economical to eliminate.

Our capacity analysis shows that available retention remains high at 23.0 percent of total assets, and deficits remain large at 22.7 percent. The available capacity measured only in SF equals 14.8 percent and the deficit shortfall in SF is 12.2 percent of total assets. About 18 per-

cent of the total capacity has high potential for consolidation with maintenance, ammunition storage, administrative offices, and unaccompanied personnel housing facilities making up the key areas for future consolidation/reduction effort consideration.

Based on the above findings, we offer the following three major looking-forward, "windshield" options to assist with consolidating the Navy's shore infrastructure.

- Establish OPNAV instruction providing uniform shore requirements policy guidance
  - — The guidance could create mission and force structure links to shore requirements by establishing a unit allowance process; require long-term cost impact assessments of size and design criteria changes; require certified end-of-year capacity analysis and planning module capture and lock; require a more robust facility site approval process; establish more stringent shore criteria standards approval and reviews; and require independent and periodic reviews to validate shore infrastructure requirements.
- Establish structure for shore cost burden identification
  - — The structure could include establishing a shore facilities working capital fund organization that would require commands to pay rent for what they need and use. In the interim, the Navy could establish mock billing procedures to improve shore cost awareness and form a stronger costing link between resourcing of fleet and shore funding to facilitate trade-off decisions.
- Establish prioritization process for shore capacity requirements
  - — This would involve using a prioritization method similar to the SSI used for evaluating facility category codes. It could be used as a process to determine which deficit shortfalls are most critical to fleet operations support.

Introduction

The Navy's shore infrastructure represents a large capital investment of public funds. In FY 2011 the infrastructure had a PRV of $207.4 billion. The inventory contains 116,189 distinct facilities of various kinds that range in size from piers and runways to bus shelters and street lights. These facilities are located at sites and installations throughout the world. The collective area of this inventory is often referred to as the "shore footprint."

Background

The Navy is entering a period of increasing fiscal constraints as projected by the FY 2013 Program Objective Memorandum (POM) and the subsequent President's Budget (PB) for 2013. There are insufficient resources in this environment to fully sustain or recapitalize the Navy shore infrastructure footprint. A previous CNA study [1] showed that historical shore infrastructure reductions have not consistently matched force structure reductions and have significantly lagged behind changes in force structure.

The Navy has recently instituted a new footprint offset requirement and consolidation initiative [2] in order to overcome the growing footprint trends; however, due to reduced funding resources, more analysis is needed in order to document opportunities for additional footprint consolidation and reductions.

Issues

The Department of Defense (DOD) continues to operate in a fiscally constrained environment; resources must be allocated to the highest priority requirements. Of primary concern are the insufficient resources in this environment both to fund the priority operational requirements and to fully sustain or recapitalize the shore infrastruc-

ture footprint. In some historical cases, reductions in shore inventories closely match force structure reductions; however, in most cases, shore inventories have remained the same or they have grown. There is not an adequate mechanism linking the size of the shore footprint to the size of the fleet. Unless shore footprint adjustments can be tied closer to force structure changes and the minimum amount necessary to support operations, the inventory will not be adequately maintained and recapitalized in the future.

Research approach

We have taken a four-part approach in conducting this study. We reviewed all DOD and Navy instructions and directives associated with shore footprint requirement determination in order to identify roles and inputs, oversight and validation processes, and frequency of update requirements in establishing the footprint size. We developed an annotated process map to document the requirements setting methodology. We met and interviewed Navy shore planners to determine the process and controls used to identify, validate, enter, maintain, and update the data in the inventory. We then identified the key process deviations and weaknesses that result in inventory data inaccuracies, inconsistencies, and variations.

Our next research effort focused on conducting an empirical analysis of shore infrastructure footprint characteristics for the past 10 years using archived, certified facility inventory data. We used this information to document the changes and trends both in average size and value by type of facility and shore capability area (SCA).

As a separate study element, we looked at documentation on the current capacity requirement and information on unit cost to determine which facility category code groups represent the greatest cost savings/avoidance opportunities associated with footprint consolidation and divestiture. We also analyzed the category code requirement surpluses and deficiencies to determine the extent of footprint violabilities and shortfalls, and their potential for support of future footprint consolidation efforts.

Finally, we used the results from the first three research efforts, integrated the findings, and applied organization management theory in the areas of planning guidance, resource allocation, organizational structure, and policy development in order to identify possible forward-looking, “windshield” options to help the Navy consolidate its shore infrastructure.

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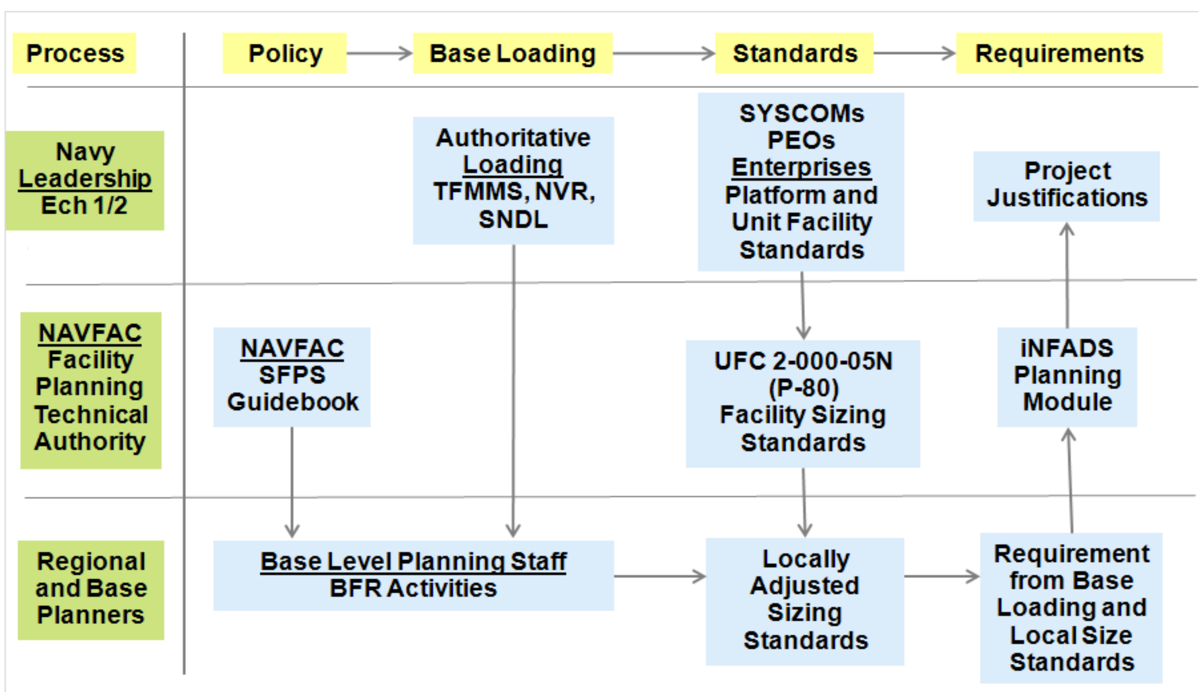
Footprint requirement determination process

The initial project task was to conduct a review of the Navy's basic facility requirement (BFR) development process. This review supports the preparation of an annotated process map and failure mode effects analysis. Our goal was to identify process weaknesses and their location within the process.

Navy BFR process review

Figure 1 shows the primary components of the BFR development process and the flow of actions. In subsequent sections, we will explain

Figure 1. BFR development process map



the phrases, levels of Navy participation, and individual steps in more detail.

This process is currently used by the Navy to determine its facility needs at an installation by facility category code for the assigned individual Navy units. The BFR development process has four major groupings of basic action steps:

Policy—The policies that provide direction and guidance for the process along with the specific procedures to be used

Base loading—The identification of the units that are located at each installation, including their level of staffing and required equipment

Standards—The guidelines to be used to determine the facility size needed to support the individual units or staff assigned to an installation

Requirements—The calculated size of the facilities needed based on the installation's base loading and naval facility sizing standards

The left axis of figure 1 identifies the three basic levels of Navy organizations that are responsible for performing each of the BFR process action steps:

Navy leadership—Typically echelon 1 and 2 organizations that make decisions and promulgate policies that directly influence the specific data used in the BFR process

Naval Facilities Engineering Command (NAVFAC)—The command that acts as the Navy's shore facility planning system technical authority

Regional and base planners—The organizations that perform the detailed, installation-level analysis that results in the determination of the specific facility requirements at an installation

Figure 1 identifies eight basic actions that are performed in the BFR process:

1. **SFPS Guidebook—**NAVFAC prepares the *Shore Facility Planning System (SFPS) Guidebook* [3], which is a detailed best-practices, how-to guide on the methods that should be used to implement the three primary steps in the Navy's shore facility planning process (basic facility requirements, asset evaluations, and facility planning documents).

   In accordance with the guidebook, BFRs use "an analysis of projected unit and personnel loading, operational considerations, activity and surrounding community conditions, and sound professional judgment" [3] to determine "the optimal shore-base footprint...to perform peacetime missions" [3]. The stated outcome for BFR final determinations is "...to be the minimal facilities necessary for efficient operation and are not directly constrained by anticipated funding levels, individual operational priorities or inefficiencies in existing facilities" [3].

2. **Authoritative loading—**Navy leadership identifies the specific units and staffing projected to be at an installation in five years. The use of a projection in lieu of current base loading is a reflection of the length of time typically needed to program for and make physical changes to a base's infrastructure. Accurate base loading forecasting is also based on a balance of the ability to project future specific unit and staffing at an installation with the long life of the Navy's facilities.

   Base loading information of this type is available from several authoritative sources including Total Force Manpower Management System (TFMMS), Naval Vessel Register (NVR), and Standard Navy Distribution List (SNDL).

3. **BFR preparation activities—**Base level facility planning staff use guidance from the SFPS guidebook and consolidate base loading information to begin their BFR preparation work plan.

4. **Platform and unit facility standards—**Navy leadership organizations, primarily the System Commands (SYSCOMs) and Program Executive Offices (PEOs), and Navy Warfare Enterprises identify the facility types and sizes needed to support the organizations and platforms that they are responsible for. Since they

are responsible for the development and future operation of these platforms and organizations, they are in the best position to identify their associated facility requirements.

5. **Documentation of facility sizing standards—**NAVFAC collects the facility sizing standards input from Navy leadership and publishes them in a Navy unique Unified Facilities Criteria (UFC) document, specifically UFC 2-000-05N [4]. Prior to the development of the DOD UFCs, this information was documented in a now superseded NAVFAC publication, P-80.

   A number of facility types represent unique facilities that are not suited to the use of these sizing standards. Special purpose buildings are examples of these types of facilities, and the BFR process typically defaults to the position that the existing facility is properly sized for its current use.

6. **Local adjustment of sizing standards—**The sizing standards in the UFC can be adjusted at the base level to reflect local conditions and variations from the unit makeup that was used to determine the Navy-wide standards.

   The NAVFAC SFPS Guidebook also allows for the use of engineering studies or a combination of studies and sizing standards to be used to determine the BFR, where the available sizing standards are not suitable.

7. **Calculate the BFR—**The base planners use the base-loading data with the sizing standards or study results to prepare a BFR for every facility category code used by each unit at an installation.

   The NAVFAC SFPS Guidebook specifies a final step for the base planner—to discuss the BFR result with the facility users and "obtain concurrence" [3] from them before considering the BFR process complete.

8. **Add BFR information to iNFADS—**After the BFR process is complete, the base planners load the resulting data and documentation into the planning module in the Internet Navy Facility Asset Data Store (iNFADS). This is the Navy's real property

inventory and data collection system. It includes facility planning information. When new BFR data are entered into iNFADS they replace prior BFR information.

Figure 1 also identifies the most prevalent use of BFR data: to provide justification for facility projects. Projects that use the DD Form 1391[2] to document appropriation requests require a statement of scope justification; these statements typically use input from the BFR process.

The second part of this process analysis was to examine the BFR process through a failure mode effects analysis.[3] This was done by identifying risks in the process that result from the lack of a critical step, or current steps that introduce significant variability or uncertainty into the process. These risks reduce expected BFR accuracy and consistency.

We analyzed each process step was analyzed using information provided by Naval Facilities Engineering Command (NAVFAC) Headquarters Asset Management staff responsible for overseeing BFR process implementation as well as by facility planning staff at Naval Air Station (NAS) Oceana, Virginia. We also reviewed the documents and data sources that provide procedural direction and direct input into the BFR calculations. In addition, we obtained current BFR information from the iNFADS Planning Module for selected bases in order to examine how procedures and data inputs affected the final BFR calculations.

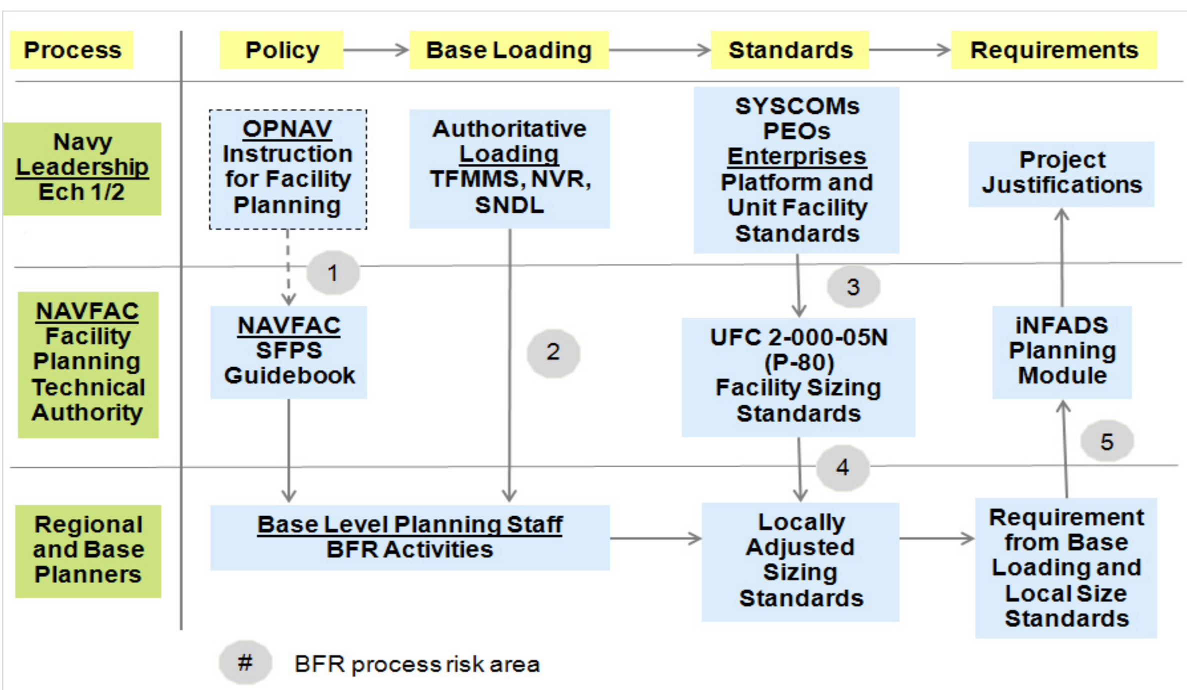
2. The DD Form 1391 is the standard DOD form used to document the nature, location, scope, complexity, costs, and urgency of a facilities project.

3. Failure mode effects analysis is a procedure in product development, systems engineering, and operations management for analysis of potential failure modes within a system for classification by the severity and likelihood of the failures. Because it forces a review of functions and functional requirements, it also serves as a form of design review. Failure modes are any errors or defects in a process, design, or item, especially those that affect the intended function of the product or process. These errors or defects can be potential or actual. Effects analysis refers to studying the consequences of those failures.

In several cases the steps involve only the presentation of guidance (SFPS Guidebook as direction to regional and base planners) or a mathematical process (base planning staff BFR calculations). These steps do not present a significant process risk.

Other steps, however, were determined during the process review to increase the likelihood that the BFR process would not produce accurate and consistent results. We also identified a missing step at the beginning of the process—a lack of clear policy guidance from OPNAV in a facility requirements determination instruction. Figure 2 identifies five process risks or problem vulnerability areas.

Figure 2. BFR development process map with problem areas



We list the five areas below:

1. Lack of policy guidance for facility planning
2. Personnel and unit uncertainties in base loading

3. Development of facility sizing standards
4. Local changes to facility size standards
5. BFR data directly loaded into iNFADS by the region/base

Lack of policy guidance for facility planning

In contrast to most Navy activities that have a major impact on Navy readiness, operations, and resource needs, there is no OPNAV instruction that provides high level policy guidance and direction on the BFR process. The lack of guidance gives a large amount of discretion to the organizations performing the BFR analysis.

Although the NAVFAC SFPS Guidebook provides some level of guidance, it is primarily a best-practices, how-to guide for facility planners who perform the analysis. The guide provides a basic policy view, that the process should identify an "optimal shore-base footprint" and "the minimal facilities necessary for efficient operation" [3]. However, it still allows significant local discretion in the process. The requirement to secure concurrence from local facility users on the BFR results as a final process step is a key example of this local influence. This can result in a less than optimal overall footprint from a Navy-wide perspective.

Personnel and unit uncertainties in base loading

A critical step in the BFR process is knowing what units and personnel will be at a base five years in the future. However, in many instances, this information is very difficult to obtain or not available. Several outside factors can affect and delay the identification of unit assignments. Many of these unit basing decisions must be evaluated through the National Environmental Policy Act (NEPA), which can take years to complete. Also, assigning units to a particular location oftentimes becomes a political issue which lengthens the decision time. For example, determining where Littoral Combat Ship (LCS) or Joint Strike Fighter (JSF) units will be assigned is important for determining a base's BFR, yet limited information is available on the ultimate homeport location of these new units.

TFMMS contains five-year projections on billet locations, which could provide useful personnel projections for the BFR calculations. However, we reviewed these data for a number of bases and the TFMMS personnel projections are usually equal to the current staffing levels and do not appear to provide realistic forecasts based on current Navy strategy and force structure predictions.

Table 1 displays information from the end of FY 2011 data from TFMMS on a small sample of Navy units with their projected billet authorizations.

Table 1. TFMMS billet data projections

Unit (UIC)	Officer billets			Enlisted billets			Civilian billets			Contractor billets		
	FY11[a]	FY12[b]	FY16	FY11	FY12	FY16	FY11	FY12	FY16	FY11	FY12	FY16
OPNAV (N00011)	590	535	535	107	100	100	1	1	1	156	156	156
NAS Oceana, VA (N60191)	14	14	14	150	150	150	54	54	54	8	7	7
NAS Lemoore, CA (N63042)	19	19	19	174	172	172	173	173	173	17	19	19
NAVSTA Mayport, FL (N60201)	12	12	12	221	221	221	81	82	82	8	7	7
Navy totals	52,964	52,635	51,977	279,993	279,971	271,720	191,511	191,555	191,882	22,458	22,310	22,282

a. All FY 2011 billet data are from the end of FY 2011 TFMMS inventory.
b. FY 2012 and FY 2016 billet data are projections found in the end of FY 2011 TFMMS inventory.

This includes end of FY 2011 billets, and FY 2012 and FY 2016 projections for officers, enlisted, direct hire civilians, and contractors. In almost all cases, the FY 2012 and FY 2016 projections are the same, which limits TFMMS manpower projection usefulness in the BFR process.

Additionally, service contractors have become a significant part of the Navy's total staffing and can cause large increases in facility needs. TFMMS contains only about 22,500 contractor billets. This is a small portion of the total service contractor support being used by the Navy. The on-site service contractors have facility needs that are similar to other Navy civilian personnel based on the Navy planning factors. However, their facility support requirements are not fully captured in the current process.

Development of facility sizing standards

Planning criteria documents are used to convert a unit's basic facility requirements into specifically sized, types of facilities to meet the unit's shore support needs. The types of facilities are identified by a facility category code. For most of the category codes, planning criteria have been published for use in the BFR process. These category code planning criteria are documented in the Navy's UFC-2-000-05N [4].

The UFC is maintained by NAVFAC personnel, who update the criteria based primarily on inputs from the SYSCOMs, Enterprises, and PEOs. These commands have the most influence because they implement introduction of new weapons platforms and fleet operational changes. When these changes increase facility requirements, they can have a significant effect on the cost of shore infrastructure. For example, when a SYSCOM increases the size requirement for a facility category code within the planning criteria for a type of operating unit, a facility shortage usually results. Changes in the facility sizing standards are sometimes implemented without full consideration of how the changes affect long-term shore cost, in part, because the SYSCOMs typically are not directly responsible for shore facility costs.

We examined changes in facility sizing standards that have occurred for carrier strike squadrons (VFA squadrons). When many of the hangars that support these squadrons at NAS Oceana, Virginia, and NAS Lemoore, California, were built, the size of a high-bay maintenance hangar module (category code 21105) was about 12,000 SF. It is now about 20,000 SF—about a 60-percent increase.

Another change that affected hangar requirements for the VFA squadrons occurred when the Fleet Response Plan (FRP) was implemented. Prior to this change, the hangar requirements were based on a unit deployment schedule that had the squadron in homeport 67 percent of the time; allowing three squadrons to share two hangars. The new requirement is for each squadron to have its own dedicated hangar—a 50-percent increase in the number of hangars required for these squadrons. This is discussed in paragraph 1-6.2.3 of UFC-2-000-05N [4].

The planning criteria documentation is organized by facility category code. However, the criteria does not include category code sizing standards for each unit type. This can lead to inconsistencies in facility requirements for the same type of unit at different bases. For example, we noted that most of the VFA squadrons at NAS Lemoore, California, have a requirement for maintenance hangar high bay space (category code 21105) that is about 1,000 SF larger than comparable VFA squadrons located at NAS Oceana, Virginia.

The lack of standards for new Navy organizations can also be a challenge for the base planner when completing a BFR. For example, the new Fleet Readiness Centers (FRCs) at air stations have changed some aspects of local aviation maintenance, but there has been minimal guidance on any changes in facility needs. The BFR for the FRC at NAS Oceana, Virginia, reflects this uncertainty. It includes administrative office space (category code 61010) for all unit staff, which considering that this is an aircraft maintenance organization, seems unnecessary.

Uncertainty about new units was also evident when we reviewed the BFR for NAVSTA San Diego, California. The calculation for general purpose ship berthing space (category code 15120) includes a detailed calculation for each assigned ship type. The current LCS operational plan calls for forward stationing these ships and using rotational crewing with overseas crew exchanges [5]. Under this plan, ships will be away from their U.S. homeport more than other Navy surface combatants. Despite this, the San Diego BFR calculates that the LCS will be in homeport as often as the other ships (77 percent of the time). This results in a higher pier requirement than would be expected.

The current BFR process identifies many valid facility deficits using the sizing standards in the planning criteria. However, the process does not provide a way to prioritize among the shortages. The planning system is unable to assist in determining how resources should be allocated when deciding which facility deficits should be eliminated. Some deficits may be causing severe operational readiness problems or costly and inefficient work-arounds, but these specific deficits cannot be identified with this process.

During our review of VFA squadron facility requirements, we noted that while 11 of 16 VFA squadrons at NAS Oceana, Virginia, have maintenance high-bay hangar space that meets current standards, none of the 13 squadrons at NAS Lemoore, California, have hangars that meet this requirement. While it is beyond the scope of this study to examine the readiness of the individual VFA squadrons, it is unclear whether the much larger hangar facility deficit at NAS Lemoore, California, is one that would be a high priority to eliminate.

Local changes to facility size standards

As noted, the NAVFAC SFPS Guidebook has a final step in BFR preparation that requires obtaining concurrence from facility users. This step could include adjustments to the requirements based on requests from the base tenants. The adjustments do not have to reflect a strict adherence to established sizing standards.

Another local change issue relates to the use of legacy facilities that may be larger than the current occupant requires. The Navy uses its facilities for many years and most are occupied by units that the facilities were not designed for. Even if an occupant is in a facility specifically designed for it when constructed, the makeup of the unit is likely to change. When a facility is too large, a portion of the facility would be considered as available space in the BFR calculation. The NAVFAC SFPS Guidebook states that facility inefficiency is not justification for an increased requirement. However, because of the potential for sustainment funding reductions for available space and the lack of funds to reconfigure the facility, there is a local incentive to adjust the requirement to equal the legacy facility size.

This type of facility inefficiency is evident when examining the BFR for an organization that has had significant staffing reductions. The Portsmouth Naval Shipyard, New Hampshire, had 8,060 civilian employees at the end of FY 1990, and 4,564 at the end of FY 2011. Many facilities at the shipyard predate FY 1990 and were sized based on the much larger Cold-War era staffing. A review of the current shipyard BFR shows that most of the shipyard shops are shown as exactly meeting the current requirement, even though they are now supporting a much smaller workforce.

BFR data directly loaded into iNFADS by region/base

Under the current BFR process, base facility planning personnel enter completed BFR results and documentation directly into the iNFADS planning module. No independent review or approval is needed before this action is taken.

The risk involved in this direct local input is increased by the process used by iNFADS when accepting the updated BFR data. The new information replaces the previously entered BFR information, which is then no longer available for review. Therefore, longer term review and trend analysis are not possible. In addition, no annual BFR data results are retained for future review. These factors make it impossible to judge the consistency of the data over time.

Footprint historical trends

We began the second part of our analysis by examining force structure changes over the past 10 years along with other potential footprint driver functions. We then extracted selected information on each facility in the Navy end-of-fiscal-year inventory (less the U.S. Marine Corps facilities) found in the Navy Shore Installations (NSI) front-end query application for iNFADS. We extracted a complete record of facilities for FYs 2001 through 2011.

Navy force structure trends

We looked at major force structure changes in both personnel and fleet assets. We determined that the greatest reduction in personnel—32 percent (44,239 billets)—was in afloat active duty billets. The next greatest reduction—4 percent (8,448 billets)—was in active duty shore billets. This difference indicates that the afloat/ashore ratio has declined from 37 percent in FY 2001 to 29 percent in FY 2011, which means that the majority of billet eliminations were in afloat billets. Since afloat billets are not ashore all the time, this reduction does not reduce the shore support requirement burden as much. In addition, Navy civilian billets have been on a steady increase since FY 2007, which has resulted in an 8-percent (13,829 billets) increase over FY 2001 levels. Figure 3 provides a summary of the personnel trends when indexed to FY 2001, which reflects an overall reduction in personnel.

Figure 3. Navy personnel billet index trends FY 2001 to FY 2011

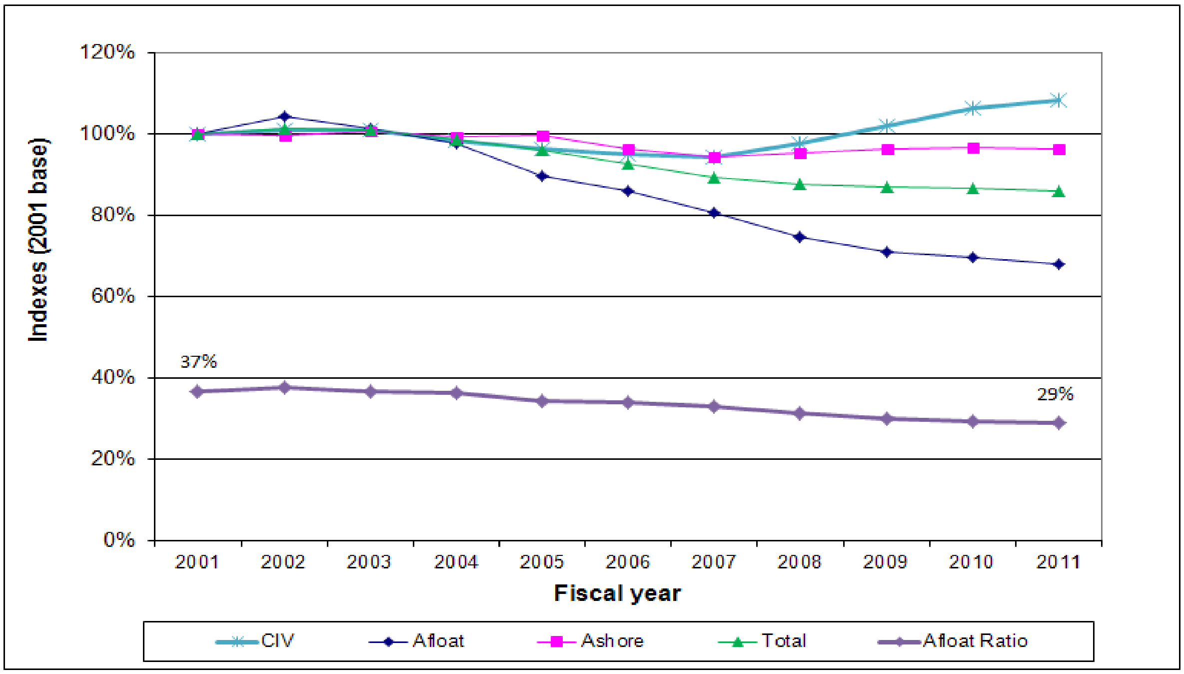
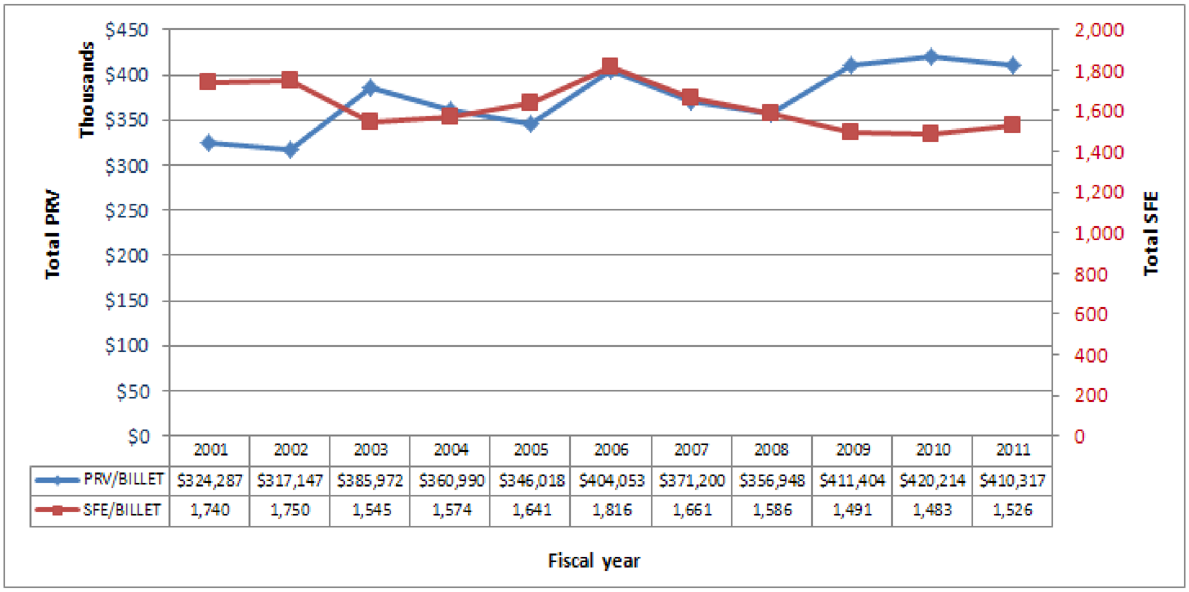


Figure 4 combines the annual personnel billet count with the total shore infrastructure inventory PRV and SFE to show the ratios of total PRV and total SFE to total billets. The net personnel change was a reduction of 38,658 billets. The net total SFE area also declined by 176 million. However, the total shore PRV increased by $30.9 million in constant FY 2011 dollars. This results in the PRV per billet ratio increasing to $410,317 in FY 2011 and the SFE per billet ratio declining to 1,526 SFE.

Figure 4. Navy personnel billet to shore PRV and SFE trends for FY 2001 to FY 2011

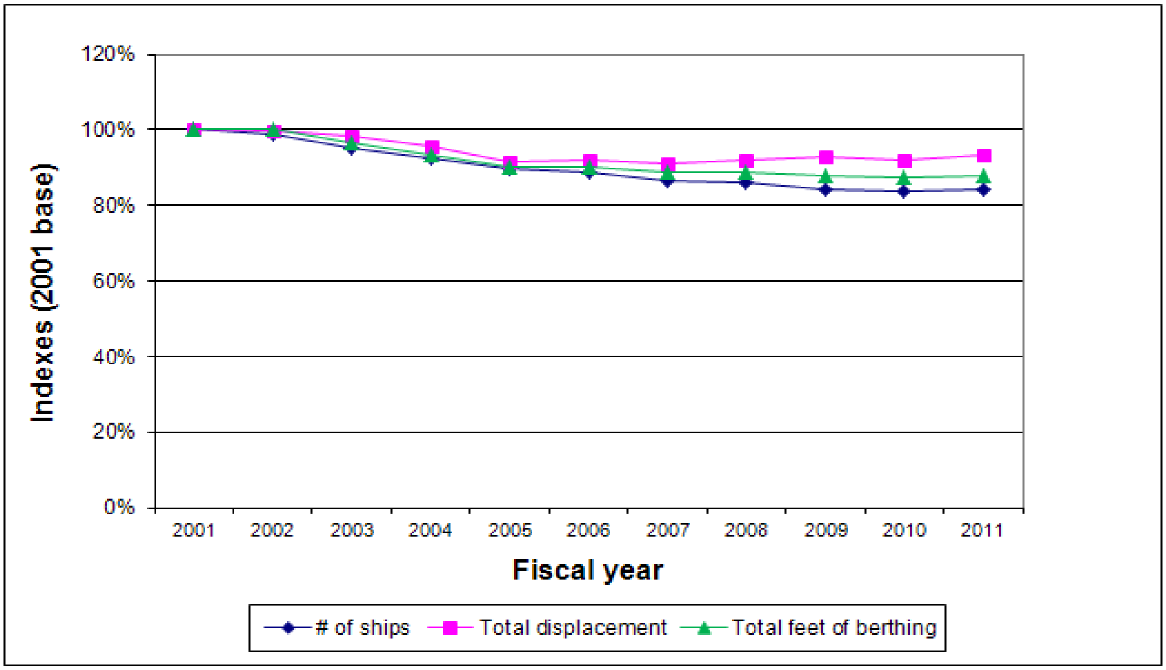


	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
PRV/BILLET	$324,287	$317,147	$385,972	$360,990	$346,018	$404,053	$371,200	$356,948	$411,404	$420,214	$410,317
SFE/BILLET	1,740	1,750	1,545	1,574	1,641	1,816	1,661	1,586	1,491	1,483	1,526

The fleet trends have also been declining. The net number of ships declined by 53 or 16 percent from the FY 2001 level.[4] Overall total displacement has declined by 7 percent or 356,003 tons. The total required berthing length plus safety margins as represented by linear feet of berthing requirement has also declined by 26,174 feet of berthing (FB) or 12 percent. Figure 5 shows these total fleet size trends as indexed to FY 2001.

4. The reductions by class were as follows: aircraft carrier (-1), cruisers (-5), frigates (-9), attack submarines (-2), command ships (-2), amphibious warfare ships (-10), mine warfare ships (-13), combat logistics ships (-1), and auxiliaries (-20). The gains by class were as follows: destroyers (+8) and littoral combat ships (+2).

Figure 5. Navy total fleet size index trends FY 2001 to FY 2011



However, when we look at individual ships, the average ship size has grown by 10 percent. The average displacement increased by 1,614 tons. The average ship berthing requirement has also increased by 3 percent or 20 FB. Figure 6 shows these trends as based on a FY 2001 baseline.

Figure 6. Navy average fleet size index trends FY 2001 to FY 2011

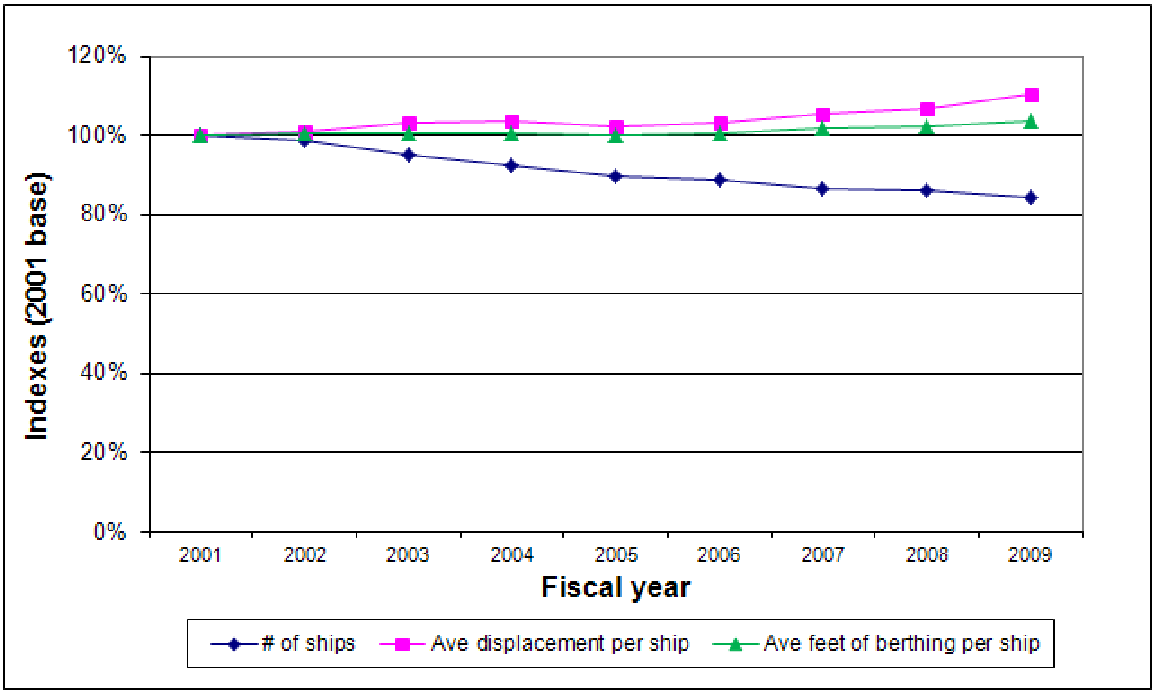
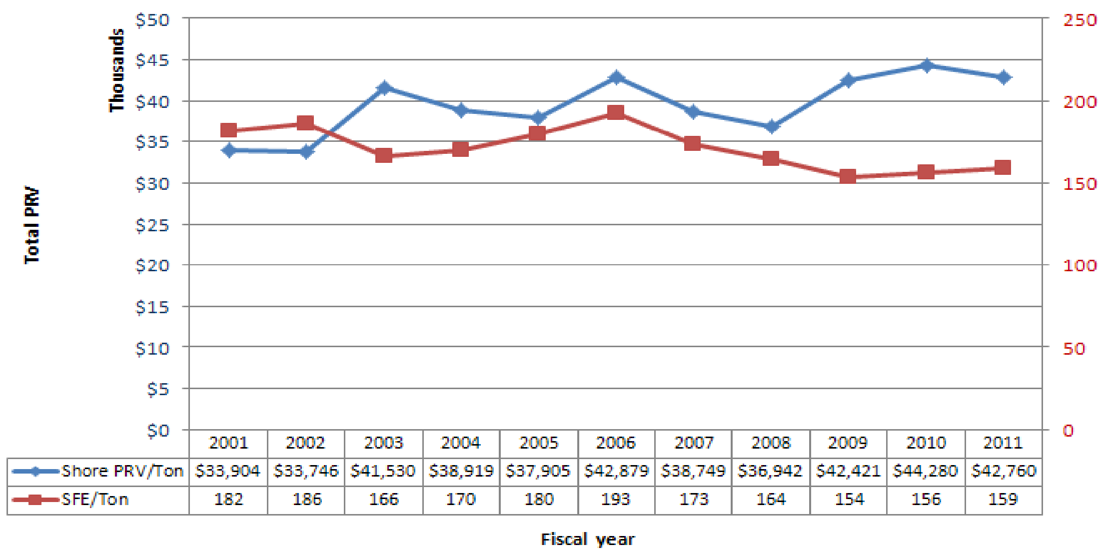


Figure 7 combines the annual total ship displacement in long tons with the total shore infrastructure inventory PRV and SFE to show the ratios of total PRV and total SFE to total fleet displacement. As mentioned earlier, the net total displacement change was a reduction of 356,003. Using the same numbers for total shore PRV and SFE, we see that the PRV per displacement ton ratio increases to $42,760 in FY 2011 and the SFE per displacement ton ratio declines to 159 SFE.

Figure 7. Navy ship displacement to shore PRV and SFE trends for FY 2001 to FY 2011



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Shore PRV/Ton	$33,904	$33,746	$41,530	$38,919	$37,905	$42,879	$38,749	$36,942	$42,421	$44,280	$42,760
SFE/Ton	182	186	166	170	180	193	173	164	154	156	159

FY 2011 current inventory composition

The first portion of the analysis identifies the composition and nature of the total inventory for FY 2011. We found that at the end of FY 2011 there were 116,196 facilities valued at $207 billion dollars. Several different units of measure (UM) are used to define the areas of the individual facilities. Table 2 provides a breakdown of the most recent certified end-of-year inventory by unit of measure.

Table 2. FY 2011 Navy inventory by unit of measure

UM	UM name	Facility count	Area	PRV[a]	Share
AC	ACRES	283	393,271	$816,344,423	0.4%
BL	BARRELS, CAPACITY	833	34,512,985	$3,937,000,587	1.9%
CF	CUBIC FEET	76	10,469,369	$14,522,293	0.0%
CY	CUBIC YARDS	3	47,891,633	$0	0.0%
EA	EACH	10,734	9,872,074	$4,271,443,627	2.1%
FB	FEET OF BERTHING	264	118,884	$365,260,912	0.2%
FP	FIRING POINT (FIRING RANGES)	71	34,754	$117,926,639	0.1%

Table 2. FY 2011 Navy inventory by unit of measure

UM	UM name	Facility count	Area	PRV[a]	Share
GA	GALLONS, CAPACITY	2,881	425,938,744	$2,548,155,255	1.2%
GM	GALLONS PER MINUTE, CAPACITY	2,560	2,952,069	$1,848,270,694	0.9%
HO	HOLES (GOLF COURSE)	48	809	$184,118,412	0.1%
KG	THOUSAND GALLONS PER DAY, CAPACITY	1,157	727,620	$2,368,618,286	1.1%
KV	KILOVOLT-AMPERES, CAPACITY (KVA)	5,102	14,244,550	$2,511,449,897	1.2%
KW	KILOWATTS	1,358	756,199	$620,883,040	0.3%
LF	LINEAL FEET	7,903	147,932,387	$13,328,686,606	6.4%
MB	BRITISH THERMAL UNITS PER HOUR, CAPACITY	177	8,402	$1,155,633,458	0.6%
ME	METERS	22	1,095	$10,873,459	0.0%
MG	MILLIONS OF GALLONS	195	247	$0	0.0%
MI	MILES, STATUTE	572	7,982	$1,710,477,880	0.8%
OL	OUTLETS, NUMBER OF	145	435	$95,013,017	0.0%
PH	POUNDS PER HOUR	4	106	$41,348	0.0%
SE	SEATS	12	2,799	$4,014,392	0.0%
SF	SQUARE FEET	72,786	499,534,302	$140,765,902,131	67.9%
SI	SITES	76	366	$3,429,054	0.0%
SP	STARTING POINT	25	397	$293,117,110	0.1%
SY	SQUARE YARDS	8,690	224,387,106	$29,700,340,407	14.3%
TH	TONS PER HOUR	17	725	$74,351,410	0.0%
TN	TONS, CAPACITY	22	6,267	$70,593,723	0.0%
TR	TONS, REFRIGERATION	174	102,909	$540,717,686	0.3%
(blank)	UNKNOWN	6	0	$0	0.0%
	Grand totals	**116,196**		**$207,357,185,746**	

a. Represents plant replacement value (PRV) in current year dollars

The Navy real property inventory system has the option of assigning up to three different units of measure for each facility category code number (CCN). They are called area, alternate, and other. Given all the different units of measure that are used, year-to-year comparisons of area are difficult to capture. We used the concept of square foot equivalents (SFE) to collapse the area measure down into one unit of measure. Since facilities measured in square feet make up 68 percent of the total PRV, it is logical to use the ratio of square feet to PRV as a basis for a conversion factor. The SFE conversion factor is found by

dividing the total square feet by the PRV of that portion of the inventory. For FY 2011 this factor is:

$$\text{SFE Factor} = \frac{499,534,302}{140,989,047,335} = 0.00354307$$

We multiply this factor by the PRV of each unit of measure to convert to SFE. Table 3 shows the conversion of units of measure to SFE, which allows us to further segment the inventory into 12 SCAs and 41 major facility CCN groups.

Table 3. FY 2011 Navy inventory by SFE unit of measure

UM	UM name	Facility count	Area (SFE)	PRV	Share
AC	ACRES	283	3,035,759	$816,344,423	0.4%
BL	BARRELS, CAPACITY	833	14,640,616	$3,937,000,587	1.9%
CF	CUBIC FEET	76	54,004	$14,522,293	0.0%
CY	CUBIC YARDS	3	0	$0	0.0%
EA	EACH	10,734	15,884,317	$4,271,443,627	2.1%
FB	FEET OF BERTHING	264	1,358,304	$365,260,912	0.2%
FP	FIRING POINT (FIRING RANGES)	71	438,537	$117,926,639	0.1%
GA	GALLONS, CAPACITY	2,881	9,475,885	$2,548,155,255	1.2%
GM	GALLONS PER MINUTE, CAPACITY	2,560	6,873,208	$1,848,270,694	0.9%
HO	HOLES (GOLF COURSE)	48	684.685	$184,118,412	0.1%
KG	THOUSAND GALLONS PER DAY, CAPACITY	1,157	8,808,236	$2,368,618,286	1.1%
KV	KILOVOLT-AMPERES, CAPACITY (KVA)	5,102	9,339,388	$2,511,449,897	1.2%
KW	KILOWATTS	1,358	2,308,892	$620,883,040	0.3%
LF	LINEAL FEET	7,903	49,565,699	$13,328,686,606	6.4%
MB	BRITISH THERMAL UNITS PER HOUR, CAPACITY	177	4,297,481	$1,155,633,458	0.6%
ME	METERS	22	40,435	$10,873,459	0.0%
MG	MILLIONS OF GALLONS	195	0	$0	0.0%
MI	MILES, STATUTE	572	6,360,794	$1,710,477,880	0.8%
OL	OUTLETS, NUMBER OF	145	353,327	$95,013,017	0.0%
PH	POUNDS PER HOUR	4	154	$41,348	0.0%

Table 3. FY 2011 Navy inventory by SFE unit of measure

UM	UM name	Facility count	Area (SFE)	PRV	Share
SE	SEATS	12	14,028	$4,014,392	0.0%
SF	SQUARE FEET	72,786	523,469,457	$140,765,902,131	67.9%
SI	SITES	76	12,752	$3,429,054	0.0%
SP	STARTING POINT	25	1,090,021	$293,117,110	0.1%
SY	SQUARE YARDS	8,690	110.447,351	$29,700,340,407	14.3%
TH	TONS PER HOUR	17	276,492	$74,351,410	0.0%
TN	TONS, CAPACITY	22	262,519	$70,593,723	0.0%
TR	TONS, REFRIGERATION	174	2,010,780	$540,717,686	0.3%
(blank)	UNKNOWN	6	0	$0	0.0%
	Grand totals	**116,196**	**771,104,023**	**$207,357,185,746**	

Four types of facilities make up the inventory: buildings, structures, utilities, and temporary facilities. Table 4 shows the mixture of facility types.

Table 4. FY 2011 Navy inventory by facility type

Facility type	Facility count	Area (SFE)	PRV	Share	Ave size	Ave value
Buildings	63,147	485,317,789	$130,506,556,844	62.9%	7,686	$2,066,710
Structures	35,603	224,102,802	$60,263,369,025	29.1%	6,294	$1,692,649
Utilities	16,196	59,799,938	$16,080,770,537	7.8%	3,692	$992,885
Temporary facilities	1,250	1,883,494	$506,489,340	0.2%	1,507	$405,191
Grand totals	**116,196**	**771,104,023**	**207,357,185,746**		**6,636**	**$1,784,547**

The Navy shore inventory structure can be functionally analyzed by aggregating individual facilities into their primary facility CCNs. The CCNs can be further consolidated into 80 shore function tasks. Finally, the shore function tasks can be organized into 12 SCAs. Appendix A provides a listing and defines each of the capability areas. Table 5 provides a breakout of the shore inventory by SCA.

Table 5. FY 2011 Navy inventory by SCA

SCA	Facility count	Area (SFE)	PRV	Share	Ave size	Ave value
Airfield operations	3,592	79,275,515	$21,317,938,031	10.3%	22,070	$5,934,838
Base support	23,195	150,330,505	$40,425,298,748	19.5%	6,481	$1,742,845
C5ISR operations	2,089	13,520,298	$3,635,736,396	1.8%	6,472	$1,740,420
Expeditionary operations	358	4,398,250	$1,182,731,163	0.6%	12,286	$3,303,718
Inter/depot level Maintenance support	2,926	70,714,716	$19,015,857,825	9.2%	24,168	$6,498,926
Ordnance/weapons operations support	7,359	34,241,125	$9,207,763,228	4.4%	4,653	$1,251,225
RDAT&E	3,608	40,336,593	$10,846,892,395	5.2%	11,180	$3,006,345
Sailor and family support	42,297	173,765,778	$46,727,265,976	22.5%	4,108	$1,104,742
Supply storage support	6,155	58,318,784	$15,682,474,142	7.6%	9,475	$2,547,924
Training support	2,201	35,730,689	$9,608,321,085	4.6%	16,234	$4,365,434
Utilities	20,744	66,087,735	$17,771,618,840	8.6%	3,186	$856,711
Waterfront operations	1,665	44,340,116	$11,923,477,822	5.8%	26,631	$7,161,248
Grand totals	**116,189**	**771,060,104**	**$207,345,375,651**		**6,636**	**$1,784,553**

The 12 SCAs can be reduced even further into three SCA groups of four SCAs each. Figure 8 shows this capability alignment.

Figure 8. Navy SCA groups

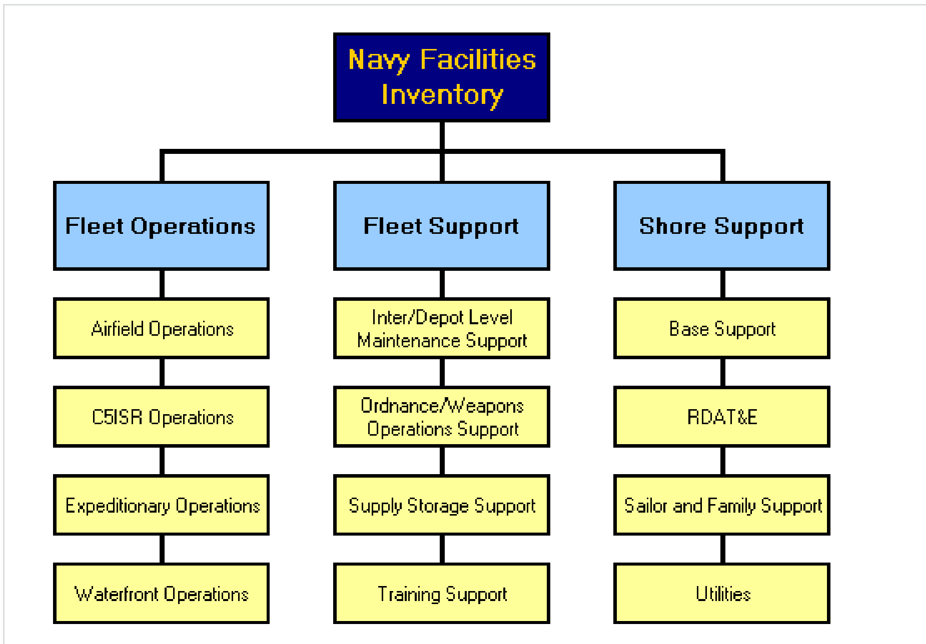


Table 6 shows the SCA group summary.

Table 6. FY 2011 Navy inventory by SCA group

SCA group	Facility count	Area (SFE)	PRV	Share	Ave size	Ave value
Fleet operations	7,704	141,534,180	$38,059,883,412	18.4%	18,372	$4,940,276
Fleet support	18,641	199,005,313	$53,514,416,280	25.8%	10,676	$2,870,791
Shore support	89,844	430,520,611	$115,771,075,959	55.8%	4,792	$1,288,579
Grand totals	**116,189**	**771,060,104**	**$207,345,375,651**		**6,636**	**$1,784,553**

Organizing the inventory by kind of facility is also helpful in trend analysis. The 1,141 individual CCNs can be collapsed into 41 major

category code groupings. Table 7 provides this type of inventory breakdown.

Table 7. FY 2011 Navy inventory by CCN group

CCN group name	Facility count	Area (SFE)	PRV	Share	Ave size	Ave value
AIRFIELD PAVEMENTS	1,095	37,488,499	$10,081,012,874	4.9%	34,236	$9,206,404
LIQUID FUELING AND DISPENSING FACILITIES	2,121	25,665,926	$6,901,810,819	3.3%	12,101	$3,254,036
COMMUNICATIONS, NAVIGATIONAL AIDS, AND AIRFIELD LIGHTING	3,129	12,067,726	$3,245,125,974	1.6%	3,857	$1,037,113
LAND OPERATIONAL FACILITIES	3,195	27,851,399	$7,489,505,447	3.6%	8,717	$2,344,133
WATERFRONT OPERATIONAL FACILITIES	1,409	52,159,940	$14,026,302,582	6.8%	37,019	$9,954,792
HARBOR AND COASTAL FACILITIES	257	872,818	$234,708,906	0.1%	3,396	$913,264
TRAINING FACILITIES	2,133	34,593,670	$9,302,566,008	4.5%	16,218	$4,361,259
MAINTENANCE	5,032	90,659,958	$24,379,322,587	11.8%	18,017	$4,844,857
PRODUCTION	570	5,708,572	$1,535,089,221	0.7%	10,015	$2,693,139
SCIENCE LABORATORIES	2,617	36,758,656	$9,884,751,208	4.8%	14,046	$3,777,131
UNDERWATER EQUIPMENT	88	1,711,489	$460,235,598	0.2%	19,449	$5,229,950
RANGE FACILITIES	311	386,254	$103,867,290	0.1%	1,242	$333,978
RDT&E OTHER THAN BUILDINGS AND RANGE FACILITIES	592	1,480,194	$398,038,299	0.2%	2,500	$672,362
LIQUID STORAGE - FUEL AND NON-PROPELLANTS	1,058	14,856,392	$3,995,024,668	1.9%	14,042	$3,776,016
AMMUNITION STORAGE	6,480	26,809,908	$7,209,438,673	3.5%	4,137	$1,112,568
COLD STORAGE	18	459,080	$123,451,052	0.1%	25,504	$6,858,392
GENERAL SUPPLY BUILDING	1,628	23,602,686	$6,346,986,272	3.1%	14,498	$3,898,640

Table 7. FY 2011 Navy inventory by CCN group

CCN group name	Facility count	Area (SFE)	PRV	Share	Ave size	Ave value
STORAGE - OPEN	294	1,308,009	$351,735,900	0.2%	4,449	$1,196,381
HOSPITAL AND OTHER MEDICAL TREATMENT FACILITIES	116	15,769,572	$4,240,587,541	2.0%	135,945	$36,556,789
LABORATORIES	73	841,256	$226,221,726	0.1%	11,524	$3,098,928
DENTAL CLINICS	21	850,424	$228,687,075	0.1%	40,496	$10,889,861
DISPENSARIES AND CLINICS	137	8,037,320	$2,161,311,604	1.0%	58,667	$15,775,997
ADMINISTRATIVE OFFICE	2,453	53,308,639	$14,335,198,597	6.9%	21,732	$5,843,946
ADMINISTRATIVE FACILITIES - UNDERGROUND	10	42,465	$11,419,242	0.0%	4,247	$1,141,924
OTHER ADMINISTRATIVE FACILITIES	1,885	177,684	$47,781,031	0.0%	94	$25,348
FAMILY HOUSING	29,226	66,072,081	$17,767,409,360	8.6%	2,261	$607,932
UNACCOMPANIED PERSONNEL HOUSING	3,380	47,085,104	$12,661,631,024	6.1%	13,931	$3,746,045
PUBLIC SAFETY AND BASE SERVICES	4,430	17,513,540	$4,709,557,136	2.3%	3,953	$1,063,105
COMMUNITY FACILITIES - INDOOR	5,820	48,343,496	$13,000,024,662	6.3%	8,306	$2,233,681
COMMUNITY FACILITIES - OUTDOOR	2,805	4,447,762	$1,196,045,422	0.6%	1,586	$426,398
MUSEUMS AND MEMORIALS	548	757,661	$203,742,179	0.1%	1,383	$371,792
ELECTRIC POWER	10,306	27,059,087	$7,276,445,096	3.5%	2,626	$706,040
HEAT AND REFRIGERATION	1,858	12,829,365	$3,449,938,013	1.7%	6,905	$1,856,802
SEWAGE AND WASTE	5,052	16,129,349	$4,337,334,995	2.1%	3,193	$858,538
WATER	4,023	12,813,010	$3,445,539,953	1.7%	3,185	$856,460
ROADS AND STREETS	6,245	31,935,860	$8,587,855,605	4.1%	5,114	$1,375,157
RAILROAD TRACKS	155	1,946,483	$523,427,613	0.3%	12,558	$3,376,952
GROUND IMPROVEMENT STRUCTURES	4,293	9,524,384	$2,561,197,179	1.2%	2,219	$596,598
FIRE AND OTHER ALARM SYSTEMS	343	0	$0	0.0%	0	$0

Table 7. FY 2011 Navy inventory by CCN group

CCN group name	Facility count	Area (SFE)	PRV	Share	Ave size	Ave value
MISCELLANEOUS UTILITIES	968	1,134,386	$305,047,220	0.1%	1,172	$315,131
BUILDINGS	15	0	$0	0.0%	0	$0
Grand totals	**116,189**	**771,060,104**	**$207,345,375,651**		**6,636**	**$1,784,553**

The maintenance fund source code indicates how a facility is supported through funding. Table 8 provides this breakdown.

Table 8. FY 2011 Navy inventory by maintenance fund source

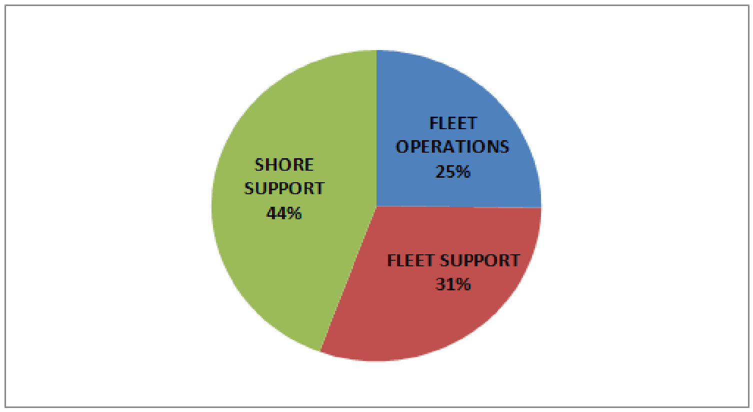
Maintenance fund source	Facility count	Area (SFE)	PRV	Share	Ave size	Ave value
O&M,N/R	47,570	406,222,006	$109,236,950,320	53%	8,539	$2,296,341
NWCF	19,172	108,800,172	$29,257,398,241	14%	5,675	$1,526,048
Joint	6,751	74,490,464	$20,031,192,269	10%	11,034	$2,967,144
Family housing	7,826	22,254,190	$5,984,362,796	3%	2,844	$764,677
BRAC	6,765	51,537,670	$13,858,968,316	7%	7,618	$2,048,628
Medical	850	29,406,875	$7,907,787,632	4%	34,596	$9,303,280
MISC	3,824	18,916,962	$5,086,950,507	2%	4,947	$1,330,269
R&D	2,048	8,722,662	$2,345,606,668	1%	4,259	$1,145,316
Public private venture	20,609	42,704,545	$11,483,657,295	6%	2,072	$557,216
GOCO	778	8,048,477	$2,164,311,702	1%	10,345	$2,781,892
Grand totals	**116,193**	**771,104,023**	**$207,357,185,746**		**6,636**	**$1,784,593**

Our Navy sponsors indicated that the portion of the inventory they are most interested in consists of facilities supported by operations and maintenance, Navy and Navy Reserve (O&M,N/R) funds. This represents slightly more than half the total inventory. The remainder is indirectly funded through Navy working capital fund (NWCF) rate structures, reimburseable accounts, and special accounts. The O&M,N/R accounts represent the vast majority of direct appropriations used to program and support the shore inventory.

FY 2011 O&M,N/R funded inventory analysis

This portion of the inventory is valued at $109.2 billion and is broken out by SCA group in figure 9.[5]

Figure 9. FY 2011 O&M,N/R SCA group distribution



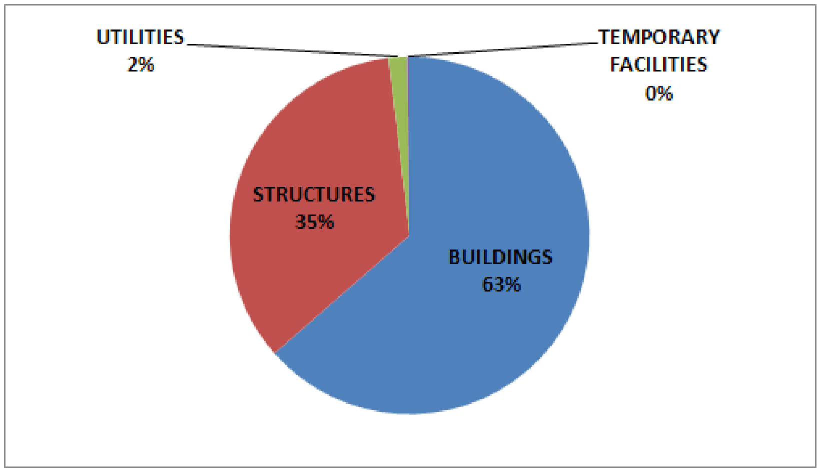
Note that a greater proportion of the inventory is dedicated to fleet operations and fleet support than in the inventory as a whole. There are 47,567 individual facilities included in the O&M,N/R supported inventory.[6]

5. A detailed breakdown of the O&M,N/R inventory by SCA and SCA group can be found in tables 13 and 14 in appendix B.

6. Table 15 in appendix B provides a detailed breakdown of facility types.

Figure 10 provides a summary of facility type distribution.

Figure 10. FY 2011 O&M,N/R facility type distribution

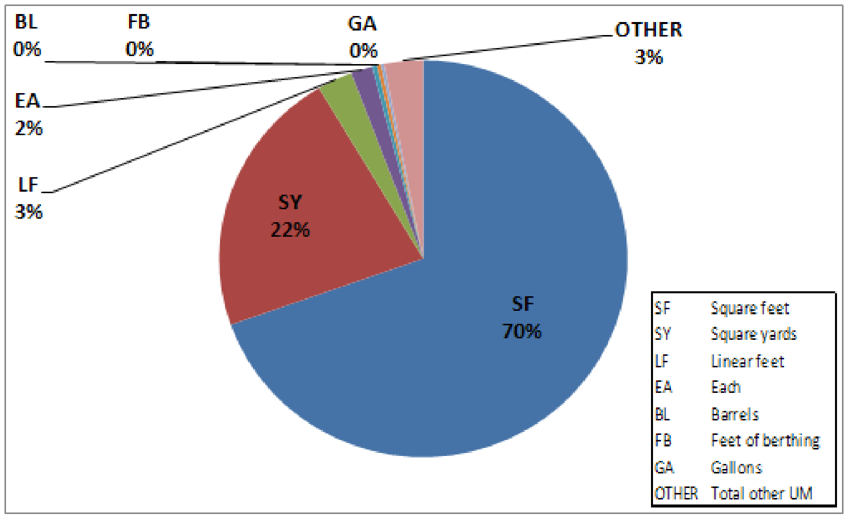


The proportion of buildings and structures is much higher in this segment of the inventory. The total area included in this part of the inventory equals 406 million SFE.[7]

7. Table 16 in appendix B has a breakdown by UM of the O&M,N/R inventory.

A summary of the distribution by unit of measure is shown in figure 11.

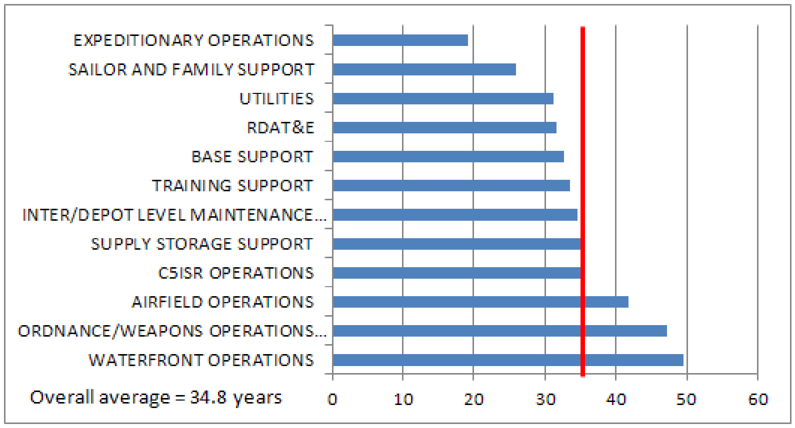
Figure 11. FY 2011 O&M,N/R unit of measure distribution



We looked at the average age from initial construction of the O&M,N/R part of the inventory by SCA.

Figure 12 shows the results of this analysis.

Figure 12. FY 2011 O&M,N/R average age distribution by SCA



The overall average age is 34.8 years, which is somewhat less than the average age of the entire inventory. Note that airfield operations, ordnance/weapons operations support, and waterfront operations are all older than the average.

The average size (8,539 SFE) and value ($2,296K) of an O&M,N/R supported facility were significantly higher than the averages for the entire inventory—almost 29 percent larger.

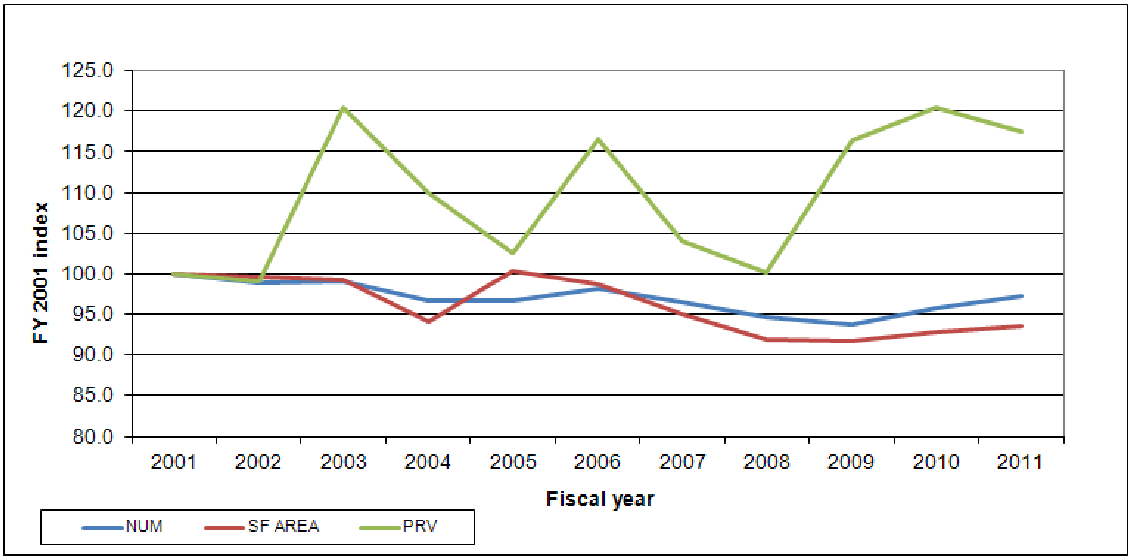
Ten-year trend analysis

Our main interest in conducting the multi-year trend analysis is to determine what changed over the 10-year period beginning in FY 2001. We looked at the number of facilities, area in SFE, and PRV in constant FY 2011 dollars for both the full inventory and the O&M,N/R inventories.

Changes to the entire Navy shore inventory

Figure 13 summarizes the changes by indexing to FY 2001.

Figure 13. Navy shore inventory index trends FY 2001 to FY 2011



The total number of facilities[8] declined at an average annual rate of 0.3 percent each year. The area measured in square feet declined at a greater rate—0.7 percent each year. However, the PRV grew an average of 1.6 percent each year. When we examine the average PRV cost per facility between these years we see very different changes between types of facilities.[9] Medical and dental facilities, waterfront operational facilities, administrative office spaces, laboratories, and liquid fueling and dispensing facilities experienced the greatest average unit cost growth.

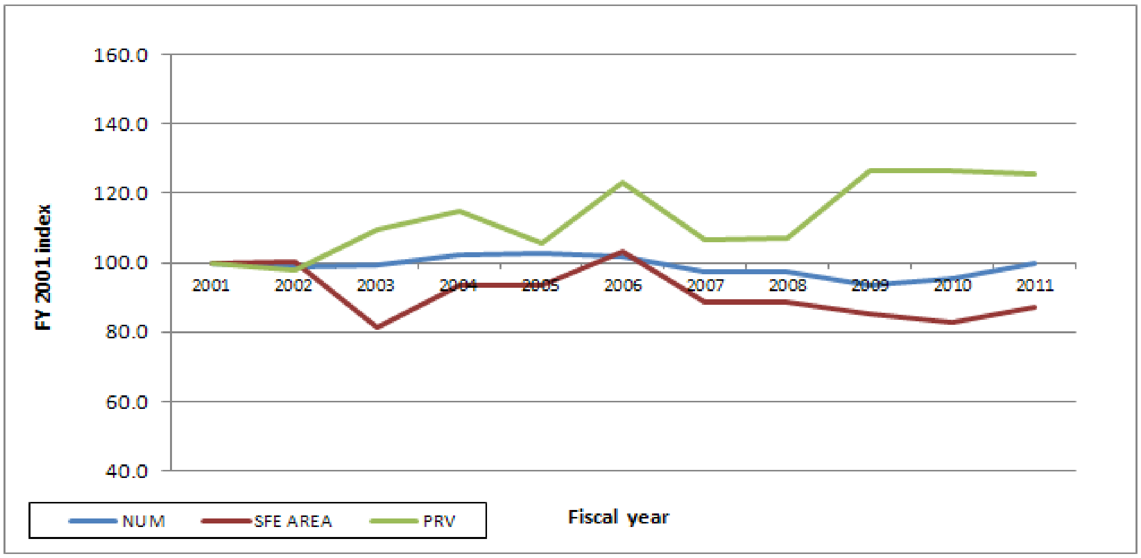
8. Table 17 in appendix B includes a summary of the total facilities count by fiscal year and SCA for the entire inventory.

9. Table 18 in appendix B includes a detailed breakdown of average PRV per facility by major CCN group.

Changes to the O&M,N/R supported portion of the Navy inventory

We next looked at the O&M,N/R portion of the inventory to determine whether the trends were any different from that of the entire inventory. Figure 14 summarizes the changes by indexing to FY 2001.

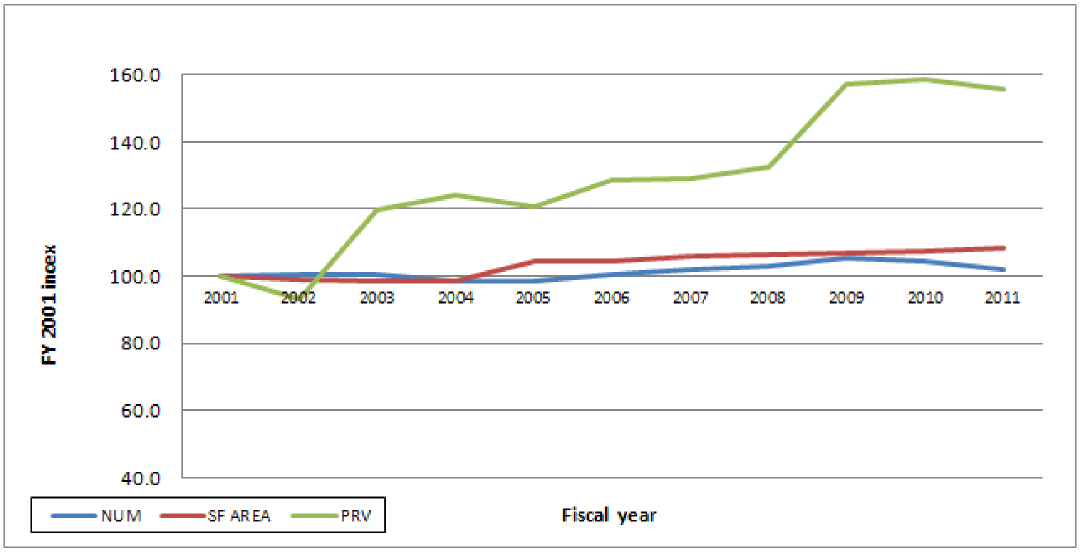
Figure 14. Navy O&M,N/R shore inventory index trends FY 2001 to FY 2011



The average annual cumulative change rate for number of facilities is flat at 0.0 percent since there were almost as many facilities in FY 2011 as in FY 2001. There was an average reduction of 1.4 percent each year in SFE. However, we see an average increase of 2.3 percent each year in PRV.

We drilled down one more level to look at those facilities that are supported by O&M,N/R funding and are measured in square feet. Figure 15 provides an index trend summary of this portion of the inventory.

Figure 15. Navy O&M,N/R shore inventory index trends FY 2001 to FY 2011 for facilities measured in square feet



From the figure, we see growth in all areas, with the number of facilities increasing by an average of 0.2 percent each year; the average annual change in square feet is 0.8 percent, and the average annual growth in PRV is 4.5 percent.

What is causing steady PRV growth above inflation?

The initial historical infrastructure analysis indicated that the overall size of the infrastructure was flat or declining, yet the cost to replace it was growing at a rate significantly above inflation. This was particularly true for O&M,N/R facilities which are measured in square feet and are mostly buildings. Two cost areas could be influencing this increase.

- Location area cost factors
- Facility unit construction cost factors

We looked first at overall Navy area cost factors weighted by PRV and found that the average annual increase between FY 2003 and FY 2011 was only 0.35 percent. We next looked at the changes in unit con-

struction costs by major CCN group, weighted by PRV, and found an average annual growth rate above inflation of 3.2 percent. We also looked at the sustainment (ST) unit cost growth. This cost factor increased as well, but at a very slow average annual rate of 0.2 percent.

Table 9 shows the CCN groups with the largest annual growth rates.

Table 9. Largest eight-year DOD average annual growth rates in unit cost

CCN group	CCN group name	Share	UM	ST	Construction
370	Range facilities	0.1%	SF	-1.0%	44.2%
120	Liquid fueling and dispensing facilities	3.3%	GM	6.2%	36.0%
150	Waterfront operational facilities	6.8%	SY	0.7%	12.8%
540	Dental clinics	0.1%	SF	10.6%	7.0%
510	Hospital and other medical treatment facilities	2.0%	SF	0.4%	6.1%
110	Airfield pavements	4.9%	SY	-0.1%	5.8%
710	Family housing	8.6%	SF	0.8%	4.9%
550	Dispensaries and clinics	1.0%	SF	7.7%	4.2%
610	Administrative offices	6.9%	SF	0.9%	4.0%
170	Training facilities	4.5%	SF	1.7%	3.9%

We conclude that despite an overall inventory size reduction, the cost burden has grown above inflation because of construction unit cost increases, which are driven by outside pressures.

Potential shore cost drivers

To better understand what outside factors are driving the increases in the cost of shore infrastructure construction, we built a significant world event and shore cost driver timeline for the period of our analysis. Figure 16 provides a summary of this timeline. We note that domestic natural disasters such as hurricanes and earthquakes tend to drive construction unit prices up as construction materials become scarce and workload increases. BRAC 2005, which included joint base consolidations as well as substantial new construction, also caused increases in inventory size and construction costs for DOD. In addition, several new laws and policy directions may increase criteria requirements, thereby increasing costs, particularly in buildings.

Figure 16. Fiscal year world event and potential shore cost driver timeline

Fiscal Year	Admin-istration	CNO	Strategy	World events	Shore drivers
2001	G.W. BUSH	ADM CLARK	ANYTIME, ANYWHERE (1997)	United States attacked Recession	
2002			SEAPOWER 21	Stock market crash OEF Afghanistan begins	
2003				Operation Iraqi Freedom begins	UFC Minimum Antiterrorism Standards for Buildings
2004				Oil prices rise IO tsunami HA	UFC NMCI Standard Construction Practices
2005				London terrorist bombing	Energy policy act Hurricane Katrina BRAC 2005
2006		ADM MULLEN	NOC 2006	Saddam Hussein executed North Korea nuclear test Lebanon evacuation	SECNAV Sustainable design and LEED silver memo
2007			COOPERATIVE STRATEGY FOR 21ST CENTURY SEAPOWER	Subprime mortgage crisis Pakistan unrest	EO 13423 High performance and sustainable buildings Energy Independence and Security Act
2008		ADM ROUGHEAD		Somalia piracy Emergency Economic Stabilization Act Georgia-Russia conflict	SECNAV Low impact development memo
2009	OBAMA			Swine flu emergency Global economic crisis	American Recovery and Reinvestment Act
2010			NAVAL OPERATIONS CONCEPT (NOC) 2010	Pakistan floods Gulf oil spill Haiti earthquake European debt crisis	
2011		ADM GREENERT		Osama bin Laden death Arab spring Japanese earthquake Operation Unified Protector (Libya)	LCS platform introduction

Another factor that we considered is the national building cost index. The Turner Building Cost Index is an industry recognized measure of changes in U.S. construction costs. The index is determined by the following factors considered on a nationwide basis: labor rates and productivity, material prices, and the competitive condition of the marketplace. Table 10 provides the average annual cost index from 1998.

Table 10. Turner building cost index annual averages

Calendar year	Average index	Year-to-year change
2011	812	1.6%
2010	799	-4.0%
2009	832	-8.4%
2008	908	6.3%
2007	854	7.7%
2006	793	10.6%
2005	717	9.5%
2004	655	5.4%
2003	621	0.3%
2002	619	1.0%
2001	613	3.0%
2000	595	4.4%
1999	570	3.8%
1998	549	4.6%

Although the Office of Secretary of Defense (OSD) unit cost adjustments lag behind industry index changes, the influence on the overall Navy inventory cost burden by the changes in outside construction cost changes is clear, particularly for the period between 2003 and 2008.

Footprint cost capacity opportunity analysis

We completed our shore requirements determination review by developing a shore capability analysis that identifies the current deficit and available quantities by both SFE area and FY 2011 PRV. We looked at the available inventory by SCA, major facility CCN groups, and installations to determine the location of the available capacity. The following text explains the process in more detail and provides the results of the analysis.

BFR data description

The planning module from iNFADS provides the database that is used to analyze the Navy infrastructure capacity. This database includes the BFR and assets associated with each unit at each location. While this is one central database, all data are entered into the system by the facility planners at each site. The data are used to show the current total requirements and capacity of the Navy shore infrastructure.

Data aggregation

This analysis is conducted at the installation and CCN level. Since each BFR is associated with a unit and not a facility, we aggregated the individual entries up to the installation level. This process allows us to show the total assets and requirements at each installation in each CCN and nets out any site-level differences in assets and requirements.

All units are designated a specific CCN that identifies the main function of the unit. Each CCN is part of a larger major CCN group and an even larger SCA. The major CCN groups and SCAs are used to categorize the data since there are over 1,000 different CCNs.

Excluded installations

The planning module data do not denote the unit funding sources such as O&M,N/R or working capital fund. In an effort to limit this capacity analysis to O&M,N/R supported infrastructure, we excluded all installations designated by DOD as government-owned contractor-operated (GOCO), base realignment and closure (BRAC), or medical installations.

The planning module also includes the joint bases NSA Andersen Guam; Joint Expeditionary Base Little Creek, Virginia; Joint Base Anacostia-Bolling, Washington, D.C.; and Joint Base Pearl Harbor-Hickam, Hawaii. After examining the data, we excluded the joint bases because complete BFRs do not exist for these installations. In the dataset, the assets are listed but many of the requirements are reported as zero. This is representative of the fact that these joint bases have not gone through the full BFR process. We exclude these installations to prevent them from skewing the analysis and because it is not possible to determine which parts of the installation are funded through O&M,N/R. However, we strongly recommend that the Navy evaluate the infrastructure at these joint bases and develop the proper BFR standards and guidance.

Excluded CCNs

We made one additional data exclusion to develop our sample. We excluded any entry in a CCN for which a requirement does not exist. The data in these entries listed the assets but then listed a zero as the requirement, so they do not provide any capacity information. The most common CCNs without requirements are in utilities and family housing.

Lastly, we pulled all the BFR data from the planning module on January 20, 2012. As discussed earlier, the planning module is continuously updated and changing so we obtained the data on a single day to have a consistent dataset that would be representative of the end of 2011.

Using the Navy facility inventory to standardize BFR data

Square feet equivalents (SFEs)

Similar to the information found in the section on "FY 2011 current inventory composition," each of the BFR entries in the database is reported in the primary unit of measure of the CCN. There are a large variety of units of measure, which makes it difficult to compare BFRs. To mitigate this issue, we converted all the assets and BFRs into SFE to allow for a simple comparison of quantities across different units of measure. Each BFR that was not already measured in square feet was multiplied by the SFE factor for that unit of measure.

Average PRV per SFE

We also standardized the data by assigning a dollar value to each of the BFR entries. We accomplished this by calculating the aver-age PRV per SFE for every CCN at each installation in the Navy facility inventory. We were then able to approximate the cost of each requirement by multiplying the BFR SFE quantity by the average PRV per SFE. By calculating this cost at the installation level, the BFR values retained the regional cost differences. This allows the values to vary by the size of the requirement and by the different area cost factors associated with the different installations.

Capacity

To provide an overview of the Navy infrastructure capacity, we present the standardized BFR data in this section. The data are first aggregated at the highest level and then broken down into SCA and major CCN groups.

Overall capacity analysis

Table 11 presents the total BFR data minus the exclusions explained earlier. The first column (A) shows that our data extraction from the planning module has total assets of over 485 million SFE, which are worth about $137 billion. The second column (B) shows that total required quantity and value are slightly below the total assets.

The third (C), fourth (B-C), and fifth (A-C) columns provide the capacity analysis for the sample. Since the BFR data are aggregated at the installation and CCN level, these columns show that a mismatch exists in infrastructure assets and requirements across the Navy. The third column (C) provides the total sum of assets and the value when the assets equal the requirements in the data. This shows that about 77 percent of the infrastructure assets match the requirements. The deficit column (B-C) shows the difference between the required area and the area of assets that meet the requirement. About 23 percent of the infrastructure does not have assets that meet requirements.

Table 11. BFR totals

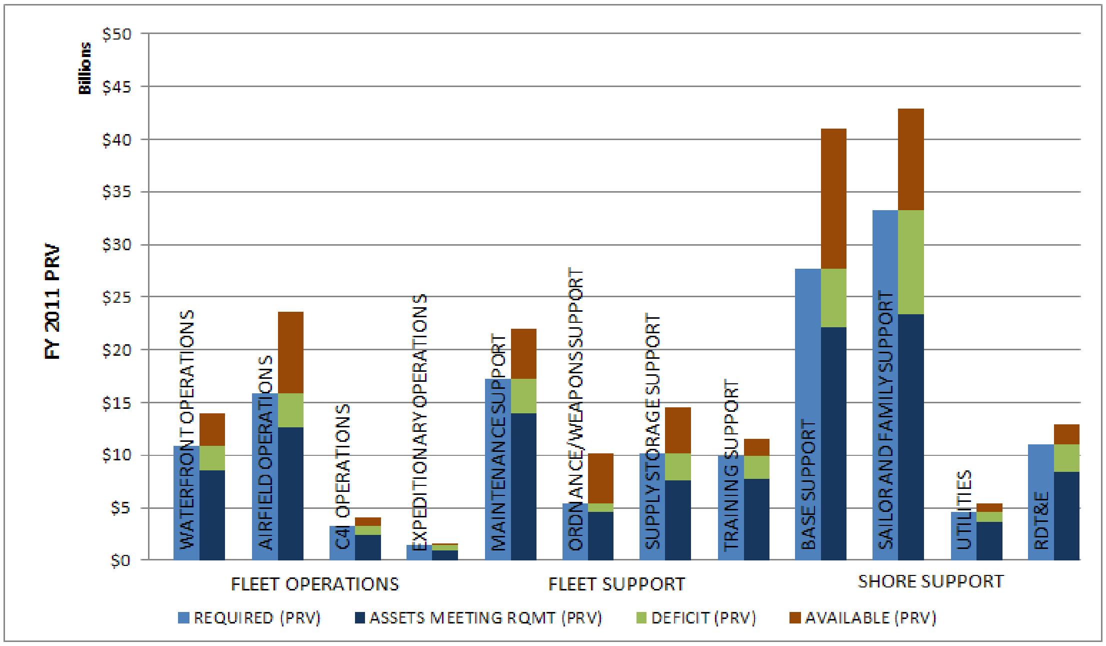
Measures	Assets (A)	Required (B)	Assets meeting requirements (C)	Deficit (B-C)	Available (A-C)
SFE	485,707,298	477,682,613	372,947,648	104,734,966	112,759,650
PRV in millions of $FY11	$137,609	$136,745	$105,497	$31,248	$32,111

Finally, the last column (A-C) shows the total sum of assets and values over and above the requirement for that unit. The sample has about $32 billion dollars in available value that is over and above the requirements. Again, although the overall number in the "Assets" column is only slightly larger than the number in the "Required" column, the large deficit and available values show that there is mismatch across the Navy between assets and requirements. The following sections show where the differences are the largest.

Breakdown by SCA

Figure 17 breaks down the numbers presented in table 11 to show the capacity analysis by SCA. This figure shows the areas of the Navy infrastructure that have the most available area and deficit value. The definitions for "Required," "Assets meeting requirement," "Deficit," and "Available" are the same as above. This figure presents the PRV measure of each of these categories.

Figure 17. Capacity analysis by SCA



This figure shows that the base support and sailor and family support SCA have the largest amount of available value and also the largest deficit value. Combined, these two areas account for almost 50 percent of the overall required value and each has available value of over $7 billion. Base support has a much higher deficit value of about $9 billion, while sailor and family support shows a deficit value of about $4 billion.

Two of the other areas with large available values are airfield operations and supply and storage support. Both of these areas have available space of about $3 billion and relatively similar deficit values. These four areas provide the highest combination of percentage of the inventory, and available and deficit space. They are highlighted in the last section of this report.

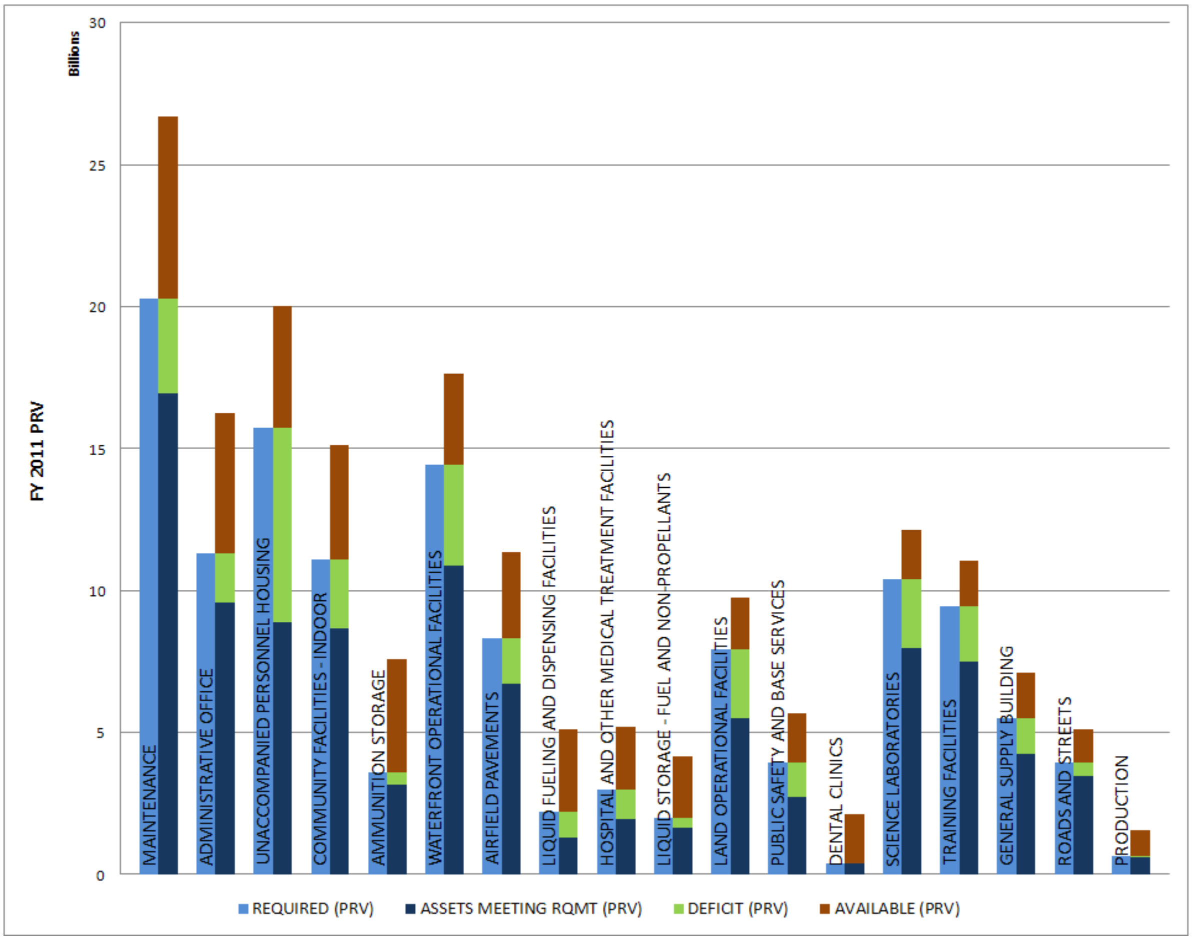
Breakdown by major CCN

Before looking at the reduction opportunities, it is insightful examine the capacity analysis by major CCN group. As mentioned previously, each CCN is part of a major CCN group and then an even larger SCA. However, there is not a direct relationship between major CCN group and SCA. For example, a CCN in the major CCN group of maintenance could be in the SCA of maintenance support, airfield operations, or base support.

Figure 18 presents the 18 major CCN groups that have about $0.5 billion of available value or more. The groups are arranged in descending order by available value. The maintenance group has the largest available value of about $3.5 billion and is also the CCN group with the highest percentage of overall requirement. The $18 billion requirement is about 13 percent of the overall required value. The individual CCNs in the maintenance group that have the most available value are building and street maintenance/repair support ($0.9 billion), aircraft hangar support ($0.8 billion), ship repair, maintenance and modification support ($0.75 billion), and aircraft repair, maintenance and modification support ($0.6 billion).

The next three major CCN groups—ammunition storage, administrative office, and unaccompanied personnel housing—each have available values of around $3 billion. However, the amount of deficit value varies greatly within the three categories. Ammunition storage has a small deficit value of $0.4 billion, unaccompanied housing has a large deficit value of over $6 billion, and administrative offices is in between with a value of $1.6 billion.

Figure 18. Capacity analysis for the major CCN groups with largest amount of available value



Infrastructure reduction opportunities

In this section, we show the total available value within four SCAs at specific installations. This allows us to highlight the best opportunities for infrastructure reduction. These are the installations and SCA areas that should be examined for potential infrastructure savings. We used a two-step process to ensure that the available value has a combination of high value and low mission criticality.

Average demolition cost

In the first step of the process, we identify CCNs that would be economically beneficial to remove from the inventory. We used a dataset of all FY 2009 and FY 2010 demolition projects to calculate an average demolition cost. We extracted the demolition expenditures in FY 2011 dollars and area demolished from each of the projects, and we calculated the SFE of the area demolished and the demolition cost per SFE. The average demolition cost per SFE of all projects was $61.97. This provides a threshold above which it is economically beneficial to reduce the infrastructure if the PRV per SFE of the CCN exceeded $61.97. We limited the reduction opportunities to only include CCNs whose average value per SFE was greater than the average demolition cost.

Strategic support index (SSI)

In addition to the average demolition threshold, we excluded CCNs that were above a mission criticality threshold. As mentioned previously, the SCA groupings are composed of multiple CCNs. Each CCN has an SSI score. The SSI determines the mission criticality of each of the CCNs.[10] The index ranges between 1 and 5, where 1 is the least mission critical and 5 is the most critical. We excluded any CCN with an SSI greater than 3 to ensure that the highlighted areas were low on the mission criticality scale.

Installations

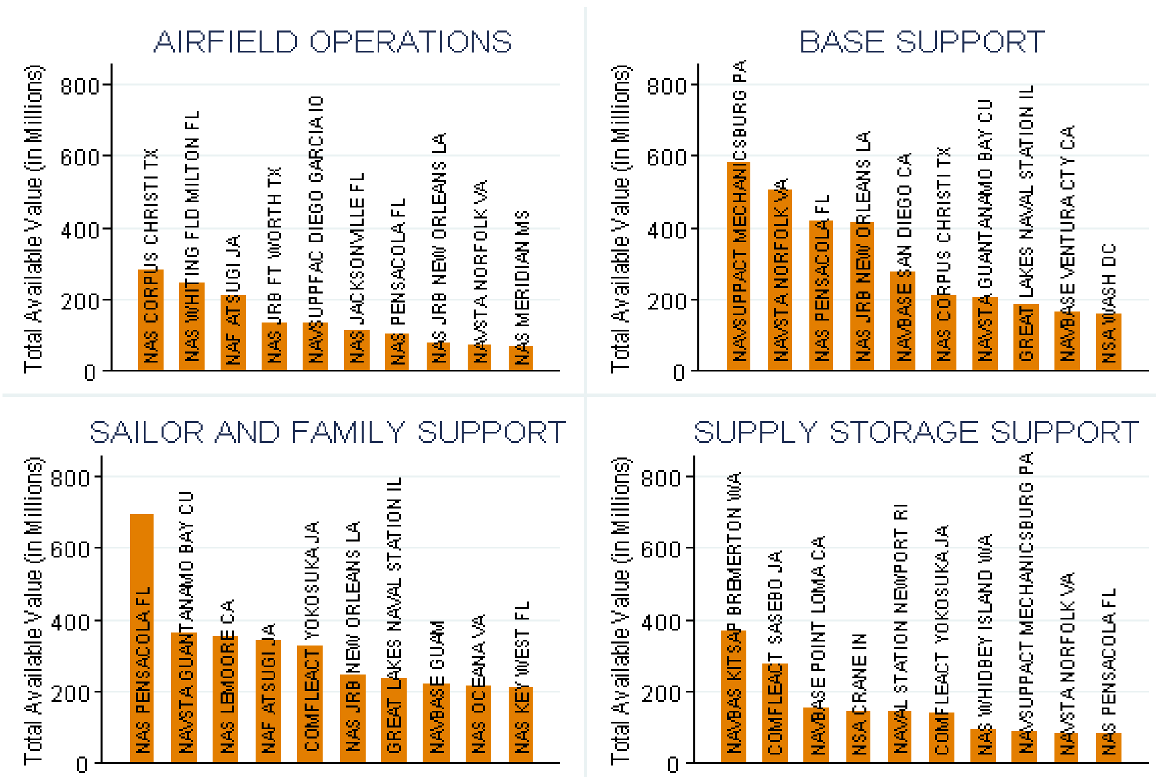
For each installation, we calculated the total available value by SCA excluding the CCNs that were below the demolition threshold or above the SSI threshold. The 10 installations with the highest available value are shown in figure 19.

10. This index is similar to the mission dependency index (MDI) that is associated with an individual facility. We use the SSI score instead of the MDI since our data are at the CCN level.

This figure shows the results for the four SCAs that have the highest proportion of overall value and that have the highest available value.[11] They are:

- Airfield operations
- Base support
- Sailor and family support
- Supply storage support

Figure 19. Installations with highest infrastructure reduction opportunities by selected SCA



11. See appendix C for the 10 highest availability installations for all 12 SCAs.

This figure reinforces the fact that the areas with greatest opportunity for reduction are in base support and sailor and family support. The base support graph shows that Naval Support Activity Mechanicsburg, Pennsylvania, has about $600 million in high opportunity available space, and Naval Station Norfolk, Virginia; Naval Air Station Pensacola, Florida; and Naval Air Station New Orleans, Louisiana, all have over $400 million in high opportunity available space. The graph also shows that NAS Pensacola, Florida, has over $600 million in high opportunity space in sailor and family support.

Overall, this figure shows the installations that have the most high opportunity available space. To be clear, it is not our recommendation that all this available space be removed. Our recommendation is that these areas and installations be prioritized when developing projects to reduce infrastructure.

Capacity analysis conclusion

Our capacity analysis relied on the BFR data obtained from the iNFADS planning module. The requirements were standardized using SFE and the value was approximated using the average PRV per SFE within each CCN. This allowed us to show the areas and values of space where the Navy is meeting requirements, has a deficit, or has availability. The data were used to show which installations have the most available space that would provide the highest opportunity for reduction. This analysis can be used to help guide the special projects process to focus on those areas with the most capacity.

Conclusions

The Navy shore infrastructure is a very large and valuable asset for the nation, but it requires significant resources to maintain and recapitalize. Management of these assets is a complex process that requires specialized facilities related expertise and experience. This research has identified several related issues that, through their interaction with each other, have resulted in a shore inventory footprint that is larger than necessary, given current and projected Navy operational requirements.

Shore footprint consolidation issues

We identified five BFR process risk areas that prevent the Navy from consistently identifying the minimum facility requirements. We describe each below.

Lack of policy guidance for facility planning

Since there is no DOD or OPNAV instruction that provides policy guidance on how to determine shore requirements, it is not surprising that we found little consistency among requirements for similar commands at different locations. The sole guidance document is a publication by NAVFAC, *Shore Facilities Planning Guidebook*, which is a detailed best-practices, how-to guide rather than a policy directive. The current requirement setting process is not constrained by funding availability considerations, and the final step in BFR development is to obtain concurrence from local facility users instead of from an authoritative allowance authorization.

Uncertainty in future personnel and unit base loading

It takes a minimum of three to five years to plan and execute adjustments to the shore infrastructure. Given this time frame, facility planners should be able to access base loading levels for at least five years

into the future in order to effectively plan new requirements. However, we found that this future base loading information is currently not available in the Navy's planning system. Total force manpower management system (TFMMS) five-year allowance projections are usually current billet counts extended into the out-years. There is limited information available on service contractor positions that require government furnished shore support. We determined that there are significant delays in identifying projected unit homeport assignments mostly because of National Environmental Policy Act (NEPA) public hearing requirements and political considerations.

Development of facility sizing standards

We found several vulnerability issues with the process used to develop facility sizing standards. Seemingly small changes in operational and technical standards can create very large changes in total facility requirements even though the force structure remains the same. Implementation of the Navy's FRP caused a standards change to allow increased homeport time. As a result, there was a 10-percent increase in ship berthing requirements. Aviation squadron hangar requirements increased by 50 percent when it was decided that each squadron needed a dedicated hangar instead of sharing hangars as units rotated through deployments.

Local changes to facility size standards

We found that the current emphasis on making requirement adjustments to meet local requests without sufficient higher authority oversight has resulted in inconsistencies across the Navy. Many of the changes are driven by legacy facility inefficiencies. The inefficiencies are transferred and embedded in the requirements system. The net effect is that requirements end up equaling existing assets regardless of mission workload or actual minimum facility requirements.

Direct input of planning data into iNFADS

Field planners directly input requirement changes into the Navy's requirement system without oversight or review. There is limited cross-checking or data comparison to validate the information being entered. Moreover, the current system is a real-time continuously

changing system with no periodic system captures and retention for historical audits or trend analyses.

Potential future consolidation actions

Identifying the above process and systematic vulnerabilities led us to the following potential actions. The actions could be implemented to mitigate or remove the inherent process issues that we found and assist with consolidating the Navy shore infrastructure in order to reduce costs.

We found, through analysis of the footprint requirement determination process, historical footprint changes, and inventory cost/capacity, that the shore footprint issues could be integrated into three main categories of possible future actions. The actions are strategic in nature. We consider them to be Navy-enterprise-level initiatives that would begin to shape the shore infrastructure into only the minimum amount necessary to support the Navy's current and future fleet mission requirements as captured in the Naval Operations Concept (NOC).

- Establish OPNAV instruction providing shore requirements policy guidance
- Establish structure for shore cost burden identification
- Establish prioritization of shore capacity requirements

Each of these forward-looking, "windshield option" areas have several specific action items that can be considered for future implementation.

Shore requirements policy guidance

Six different actions could be taken to address current process vulnerabilities related to shore requirements policy guidance.

Facilities unit allowance process

In our BFR process analysis, we noted a weak connection between force structure adjustments and shore requirement changes. The current approach appears to be location oriented rather than focused on

the specific support requirements of individual organizations. The process looks at the resource problem from a shore base commanders perspective of "what do I need to have to support my tenant commands" rather than from a mission allowance perspective of "what are the minimum shore support requirements necessary to allow a Navy command to perform its mission." Our proposed action would require development of unit tables of facility allowance for each Navy unit. These unit facility tables of allowance would compliment the already existing unit tables of allowance for personnel, equipment, and supplies. Although this requirement would take funding and time to execute, once implemented, it would link shore requirements directly to individual units who have the requirement. This information would significantly improve the linkage between units and shore facility requirements and allow better force lay-down analysis.

Cost impact assessments of criteria changes

We discovered in our process review that facility requirement criteria changes are processed by OSD and the services with no requirement to perform a long-term assessment of cost. We recommend that future change recommendations to Navy shore size and design criteria be required to include a long-term cost analysis as part of the consideration package.

End-of-year capacity analysis capture

In our review, we found that the current Navy planning module data store is managed as a real-time repository of current information. Since end-of-year certified summary reports are not captured, it is impossible to conduct trend analyses or determine what past levels of requirements might have been. We recommend that the Navy generate and capture an end-of-year certified requirements report to document the current level of shore requirements at that time.

More robust facility site approval process

As we noted in our study, facilities cannot be easily or efficiently relocated or repurposed after they are built. With the many adjustments in force structure and unit location that are currently being pursued, it would be wise to establish a more robust facility site approval pro-

cess in order to better ensure that required capacity is located in the best places to serve long-term Navy needs.

More stringent shore criteria standards approval and review

We found in our review that adjustments to shore requirements criteria standards, whether design related or operationally driven, can have long-term and major cost implications for the Navy. For this reason, we feel that it would be helpful for the Navy to require a more stringent and higher level approval and review process for proposed changes to shore criteria standards.

Independent reviews to validate shore requirements

We also noted that the process used to determine shore requirements is largely self-generated and directly entered into iNFADS by the field with little verification of consistency, accuracy, or currency. For this reason, we recommend that the Navy institute independent and periodic reviews—perhaps using the Navy Audit Service—to validate shore infrastructure requirements and verify the quality of the information.

Shore cost burden identification

Three different cost-related actions would promote better fiscal efficiency and assist with reducing the overall size of the shore infrastructure.

Analyze potential for a shore facilities working capital fund organization

In examining the shore requirements generation vulnerabilities from a financial perspective, we noted that it is difficult to control costs when someone else is managing the funds. To that end, we believe the Navy would be best served by bringing the fleet user closer to the provider. This can be done through a working capital fund organizational structure where users pay rent at a fixed rate for the level of shore support they require. By allowing the field users to determine the best use of their resources, efficiencies result. While it is no small task to establish and manage a working capital fund, the Navy has had many years of successful experience in several different support areas.

Implement mock billing procedures

In the interim, or if it proves impractical to establish a shore working capital fund structure, the Navy could implement a shore-cost mock billing process. Most Navy organizations do not have a good understanding of what their total shore support cost burden is outside of utilities and telecommunications services. Mock billing has been one technique that has consistently helped to reduce costs and provide visibility to local users. The Navy has used this technique for energy reduction and family housing programs in the past.

Form stronger costing link between fleet and shore requirements

Since fleet requirements and shore requirements do not have common measures of merit, but are both interlaced in a complex matrix of relationships, it is difficult to manage both sides in isolation. We believe it would be in the Navy's interest to form a stronger costing link between resourcing of fleet and shore funding. This would facilitate better trade-off decisions and generate greater wholeness and balance with the available financial resources.

Shore capacity requirement prioritization

Two actions could be taken to help identify and prioritize deficit capacity shortfalls. We believe these actions would help reduce the overall deficit in the most important areas. The recent creation of joint military installations has added large amounts of net capacity to the Navy's inventory; however, the original service requirements did not always accompany them. As a result, the Navy planning module could not be updated. A thorough BFR review of these locations could identify significant new consolidation opportunities.

Prioritize shore capacity requirements

In our review of the BFR generation process, we found that all deficit shortfalls are treated equally with no sense of criticality. We recommend that the Navy develop a prioritization method similar to the SSI used for evaluating facility category codes as a process to quantify shore requirements. Use of a prioritization process would allow the Navy to determine which deficit shortfalls are most critical to fleet operations support.

Update BFRs at newly established joint installations

To develop accurate BFRs for the newly established joint Navy installations, we recommend that the Navy reevaluate the infrastructure at NSA Andersen, Guam; Joint Expeditionary Base Little Creek-Fort Story, Virginia; Joint Base Anacostia-Bolling, Washington, D.C.; and Joint Base Pearl Harbor-Hickam, Hawaii. The BFR data presented in the planning module were highly inconsistent, so we excluded these bases from our empirical analysis. The lack of accurate requirement data makes it difficult to analyze the capacity at these bases; however, as a result of merging two independent installations together, there is a high probability of infrastructure redundancy at these locations.

In its' justification for the BRAC 2005 joint basing recommendation, DOD stated:

> Because these installations share a common boundary with minimal distance between the major facilities or are in near proximity, there is significant opportunity to reduce duplication of effort with resulting reduction of overall manpower and facilities requirements capable of generating savings, which will be realized by pairing unnecessary management personnel and achieving greater efficiencies through economies of scale. [6]

Accurate BFR data for these installations should reveal additional cost saving opportunities and allow for better management of the bases.

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Appendix A: Navy shore capability areas

The Navy has segmented the many shore support tasks into 12 main capability areas. Table 12 provides a list of the current shore capability areas (SCAs). The SCA descriptions are found in the *Shore Facilities Planning System Guidebook* [3].

Table 12. Navy SCA list

Short title	Name	Brief description
Waterfront OPS	Waterfront operations	Waterfront operations provide capability ashore to support the Navy's current and future surface, submarine, and CVN force requirements.
Airfield OPS	Airfield operations	Airfield operations enable readiness, operations, and training; aircraft maintenance and protection; and movement of personnel and material.
C5ISR OPS	Command, control, communications, computers, combat systems, intelligence, surveillance, and reconnaissance operations	C5ISR operations ensure Navy warfighters have the systems, processes, and knowledge required to make rapid and well-informed, effects-based decisions, to degrade our enemies' decision capabilities, and to influence the decision-making of others in all phases of operations.
Expeditionary OPS	Expeditionary operations	Expeditionary operations provide adaptive force packages of naval expeditionary capabilities to warfighting commanders for integrated maritime expeditionary missions that extend the maritime operating environment ashore.
Maintenance support	Intermediate and depot level maintenance support	Intermediate and depot level maintenance support provides depot, intermediate, and operations level required operational availability for all platforms; weapons and weapon systems; and the essential ability to reprioritize work without contractual impediment.
Ordnance support	Ordnance and weapons operations support	Ordnance and weapons operations support maintains a strategically located, optimally stocked ordnance inventory that is well protected, and it maintains and meets the maritime weapons requirements of globally distributed forces.

Table 12. Navy SCA list

Short title	Name	Brief description
Training support	Training support	Training support sustains a Navy manpower, personnel, training, and education system that targets and attracts the right group of personnel to train, develop, equip, and motivate throughout Navy service.
Supply support	Supply and storage support	Supply and storage support sustains and operates an on-time material, ordnance, and fuel delivery logistic network to the Navy's globally distributed forces.
Sailor & family support	Sailor and family support	Sailor and family support enables a ready Navy force through programs for housing, morale, welfare, and recreation; child development and youth; galley; fleet and family support; and personnel support.
Utilities support	Utilities support	Utilities support provides all the utilities services necessary to support ongoing fleet and shore utilities requirements.
Base support	Base support	Base support provides and protects shore network and facility infrastructure that promote quality of life and service and a safe place for the fleet, the fighter, the family, and civilians.
RDAT&E support	Research, development, acquisition, testing, and evaluation support	RDAT&E is used by the Navy for state-of-the-art RDAT&E at all levels of research, with flexibility to adapt to Navy transformational mission changes and joint operations.

Appendix B: Data reference tables

This appendix contains backup data reference tables that were used to generate the results provided in the main text. We provide these tables to document the information we used to develop the analysis described in this report.

Table 13 provides a summary of O&M,N/R supported inventory by SCA.

Table 13. Navy FY 2011 O&M,N/R inventory by SCA

SCA	FAC	SFE	PRV	Share	Ave size	Ave value
Airfield operations	2,378	52,651,896	$14,158,594,204	13.0%	22,141	$5,953,993
Base support	15,676	86,840,186	$23,352,149,675	21.4%	5,540	$1,489,675
C5ISR operations	1,653	10,056,266	$2,704,225,185	2.5%	6,084	$1,635,950
Expeditionary operations	315	4,154,678	$1,117,232,259	1.0%	13,189	$3,546,769
Inter/depot level Maintenance support	2,064	48,264,868	$12,978,880,884	11.9%	23,384	$6,288,217
Ordnance/weapons operations support	3,626	18,167,831	$4,885,502,117	4.5%	5,010	$1,347,353
RDAT&E	291	3,923,016	$1,054,936,106	1.0%	13,481	$3,625,210
Sailor and family support	10,496	84,296,868	$22,668,227,482	20.8%	8,031	$2,159,702
Supply storage support	3,200	24,356,370	$6,549,658,853	6.0%	7,611	$2,046,768
Training support	1,908	32,629,624	$8,774,415,282	8.0%	17,101	$4,598,750
Utilities	4,692	5,210,123	$1,401,051,472	1.3%	1,110	$298,604
Waterfront operations	1,268	35,626,362	$9,580,266,706	8.8%	28,097	$7,555,415
Grand total	**47,567**	**406,178,087**	**$109,225,140,225**		**8,539**	**$2,296,238**

Table 14 provides a summary of O&M,N/R supported inventory by SCA group.

Table 14. Navy FY 2011 O&M,N/R inventory by SCA group

SCA group	FAC	SFE	PRV	Share	Ave size	Ave value
Fleet operations	5,614	102,489,201	$27,560,318,354	25.2%	18,256	$4,909,212
Fleet support	10,798	123,418,693	$33,188,457,136	30.4%	11,430	$3,073,574
Shore support	31,155	180,270,193	$48,476,364,735	44.4%	5,786	$1,555,974
Grand total	**47,567**	**406,178,087**	**$109,225,140,225**		**8,539**	**$2,296,238**

Table 15 provides a summary of O&M,N/R supported inventory by facility type.

Table 15. Navy FY 2011 O&M,N/R inventory by facility type

Facility type	FAC	SFE	PRV	Share	Ave size	Ave value
Buildings	20,977	258,043,740	$69,390,409,275	63.5%	12,301	$3,307,928
Structures	21,950	140,534,147	$37,790,965,034	34.6%	6,402	$1,721,684
Utilities	3,814	6,713,306	$1,805,271,638	1.7%	1,760	$473,328
Temporary facilities	826	886,894	$238,494,278	0.2%	1,074	$288,734
Grand total	**47,567**	**406,178,087**	**109,225,140,225**		**8,539**	**$2,296,238**

Table 16 provides a summary of O&M,N/R supported inventory by unit of measure.

Table 16. Navy FY 2011 O&M,N/R inventory by unit of measure

Unit of measure	FAC	SFE	PRV	%	Ave size	Ave value
Square feet	26,555	282,698,002	$76,020,174,225	70%	10,646	$2,862,744
Square yards	6,060	88,782,458	$23,874,445,121	22%	14,651	$3,939,677
Linear feet	3,500	11,364,420	$3,056,000,248	3%	3,247	$873,143
Each	6,931	6,905,936	$1,857,071,708	2%	996	$267,937
Barrels	156	1,628,289	$437,862,478	0%	10,438	$2,806,811
Feet of berthing	227	1,251,927	$336,654,919	0%	5,515	$1,483,061

Table 16. Navy FY 2011 O&M,N/R inventory by unit of measure

Unit of measure	FAC	SFE	PRV	%	Ave size	Ave value
Gallons	1,110	1,011,757	$272,071,049	0%	911	$245,109
Other	3,028	12,535,298	$3,370,860,477	3%	4,140	$1,113,230
Totals	**47,567**	**406,178,087**	**$109,225,140,225**		**8,539**	**$2,296,238**

Table 17 provides a breakdown of the number of facilities by SCA and fiscal year.

Table 17. Total number of shore facilities by SCA and fiscal year

SCA name	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Airfield operations	3,501	3,497	3,480	3,440	3,451	3,393	3,249	3,196	3,277	3,418	3,592
Base support	20,646	20,528	20,768	20,761	21,157	21,870	21,536	21,278	21,464	21,985	23,195
C5ISR operations	2,495	2,487	2,405	2,350	2,183	2,188	2,080	2,014	1,911	1,964	2,089
Expeditionary operations	238	239	245	244	245	296	312	315	325	352	358
Inter/depot level Maintenance support	3,332	3,249	3,204	3,111	3,126	3,006	2,934	2,912	2,848	2,903	2,926
Ordnance/ weapons operations support	7,923	7,881	7,839	7,803	7,900	7,886	7,692	7,568	7,361	7,526	7,359
RDAT&E	3,842	3,776	3,854	3,829	3,812	3,754	3,624	3,601	3,590	3,572	3,608
Sailor and family support	46,025	45,393	45,199	43,495	42,724	43,006	41,981	41,108	40,475	41,824	42,297
Supply storage support	6,865	6,819	6,793	6,659	6,709	6,545	6,294	5,964	5,630	5,906	6,155
Training support	2,164	2,154	2,120	2,099	2,119	2,068	1,992	1,984	2,065	2,145	2,201
Utilities	20,566	20,237	20,583	19,825	20,363	21,547	21,838	21,504	21,313	21,045	20,744
Waterfront operations	1,846	1,824	1,799	1,789	1,785	1,684	1,752	1,703	1,694	1,687	1,665
Blank	57	52	44	42	37	8	0	0	3	5	7
Totals	**119,500**	**118,136**	**118,333**	**115,447**	**115,611**	**117,251**	**115,284**	**113,147**	**111,956**	**114,332**	**116,196**

Table 18 provides the average PRV cost per facility change by CCN group from FY 2001 to FY 2011 in constant FY 2011 dollars.

Table 18. Navy FY 2001-2011 ten-year average value change by CCN group

CCN Group	CCN group name	FY 2011 share	FY 2001 ave value	FY 2001 constant ave value	FY 2011 ave value	Change
510	HOSPITAL AND OTHER MEDICAL TREATMENT FACILITIES	2.0%	$17,489,906	$21,438,962	$36,556,789	$15,117,827
550	DISPENSARIES AND CLINICS	1.0%	$4,259,428	$5,221,167	$15,775,997	$10,554,830
540	DENTAL CLINICS	0.1%	$4,060,503	$4,977,327	$10,889,861	$5,912,534
150	WATERFRONT OPERATIONAL FACILITIES	6.8%	$5,459,945	$6,692,749	$9,954,792	$3,262,043
610	ADMINISTRATIVE OFFICE	6.9%	$2,486,527	$3,047,961	$5,843,946	$2,795,985
530	LABORATORIES	0.1%	$763,673	$936,103	$3,098,928	$2,162,825
120	LIQUID FUELING AND DISPENSING FACILITIES	3.3%	$987,293	$1,210,215	$3,254,036	$2,043,821
320	UNDERWATER EQUIPMENT	0.2%	$2,656,097	$3,255,818	$5,229,950	$1,974,131
170	TRAINING FACILITIES	4.5%	$2,141,229	$2,624,699	$4,361,259	$1,736,561
140	LAND OPERATIONAL FACILITIES	3.6%	$820,273	$1,005,484	$2,344,133	$1,338,650
440	GENERAL SUPPLY BUILDING	3.1%	$2,093,598	$2,566,313	$3,898,640	$1,332,327
310	SCIENCE LABORATORIES	4.8%	$2,201,046	$2,698,022	$3,777,131	$1,079,109
210	MAINTENANCE	11.8%	$3,099,668	$3,799,544	$4,844,857	$1,045,314
410	LIQUID STORAGE - FUEL AND NON-PROPELLANTS	1.9%	$2,252,277	$2,760,820	$3,776,016	$1,015,196
740	COMMUNITY FACILITIES - INDOOR	6.3%	$1,271,135	$1,558,146	$2,233,681	$675,536
420	AMMUNITION STORAGE	3.5%	$547,179	$670,727	$1,112,568	$441,840
450	STORAGE - OPEN	0.2%	$655,074	$802,984	$1,196,381	$393,397

Table 18. Navy FY 2001-2011 ten-year average value change by CCN group

CCN Group	CCN group name	FY 2011 share	FY 2001 ave value	FY 2001 constant ave value	FY 2011 ave value	Change
730	PUBLIC SAFETY AND BASE SERVICES	2.3%	$574,287	$703,956	$1,063,105	$359,149
750	COMMUNITY FACILITIES - OUTDOOR	0.6%	$138,147	$169,339	$426,398	$257,059
710	FAMILY HOUSING	8.6%	$303,680	$372,249	$607,932	$235,683
820	HEAT AND REFRIGERATION	1.7%	$1,433,857	$1,757,609	$1,856,802	$99,193
690	OTHER ADMINISTRATIVE FACILITIES	0.0%	$41,259	$50,575	$25,348	-$25,227
130	COMMUNICATIONS, NAVIGATIONAL AIDS, AND AIRFIELD LIGHTING	1.6%	$878,801	$1,077,227	$1,037,113	-$40,114
720	UNACCOMPANIED PERSONNEL HOUSING	6.1%	$3,091,146	$3,789,098	$3,746,045	-$43,053
370	RANGE FACILITIES	0.1%	$428,957	$525,811	$333,978	-$191,832
390	RDT&E OTHER THAN BUILDINGS AND RANGE FACILITIES	0.2%	$709,991	$870,301	$672,362	-$197,939
220	PRODUCTION	0.7%	$2,370,540	$2,905,786	$2,693,139	-$212,647
870	GROUND IMPROVEMENT STRUCTURES	1.2%	$704,743	$863,868	$596,598	-$267,269
830	SEWAGE AND WASTE	2.1%	$1,007,195	$1,234,610	$858,538	-$376,072
810	ELECTRIC POWER	3.5%	$935,939	$1,147,266	$706,040	-$441,226
850	ROADS AND STREETS	4.1%	$1,545,934	$1,894,991	$1,375,157	-$519,834
880	FIRE AND OTHER ALARM SYSTEMS	0.0%	$506,472	$620,828	$0	-$620,828
840	WATER	1.7%	$1,231,073	$1,509,038	$856,460	-$652,577
620	ADMINISTRATIVE FACILITIES - UNDERGROUND	0.0%	$1,524,582	$1,868,819	$1,141,924	-$726,895
890	MISCELLANEOUS UTILITIES	0.1%	$881,075	$1,080,014	$315,131	-$764,883
760	MUSEUMS AND MEMORIALS	0.1%	$1,255,808	$1,539,358	$371,792	-$1,167,566
430	COLD STORAGE	0.1%	$7,007,079	$8,589,212	$6,858,392	-$1,730,820

Table 18. Navy FY 2001-2011 ten-year average value change by CCN group

CCN Group	CCN group name	FY 2011 share	FY 2001 ave value	FY 2001 constant ave value	FY 2011 ave value	Change
860	RAILROAD TRACKS	0.3%	$4,661,983	$5,714,616	$3,376,952	-$2,337,663
110	AIRFIELD PAVE-MENTS	4.9%	$9,683,815	$11,870,329	$9,206,404	-$2,663,925
160	HARBOR AND COASTAL FACILITIES	0.1%	$3,948,642	$4,840,208	$913,264	-$3,926,944
	Overall PRV/facility ratios		**$2,452,746**	**$3,006,554**	**$3,929,696**	**$923,142**

Appendix C: Installation availability by SCA group

This appendix is a supplement to the section on opportunities for infrastructure reduction. In this appendix, we present three figures (20, 21, and 22) that show the 10 installations, by each SCA, that have the greatest potential opportunity for infrastructure reduction. Each figure contains four graphs, one for each of the SCAs within the larger SCA group. The figures are similar to figure 19 in the text on p. 53 except the total available value scale has been adjusted because NSA Crane, Indiana, has a high opportunity value equal to about $2.5 billion in ordnance/weapons support. This is much higher than any other installation; therefore, the ordnance/weapons support scale is different from the other SCA charts. The other charts have all been adjusted to $700 million to maintain the ability to compare the values across each of the figures.

Figure 20. Installations with greatest opportunity for infrastructure reductions in fleet operations

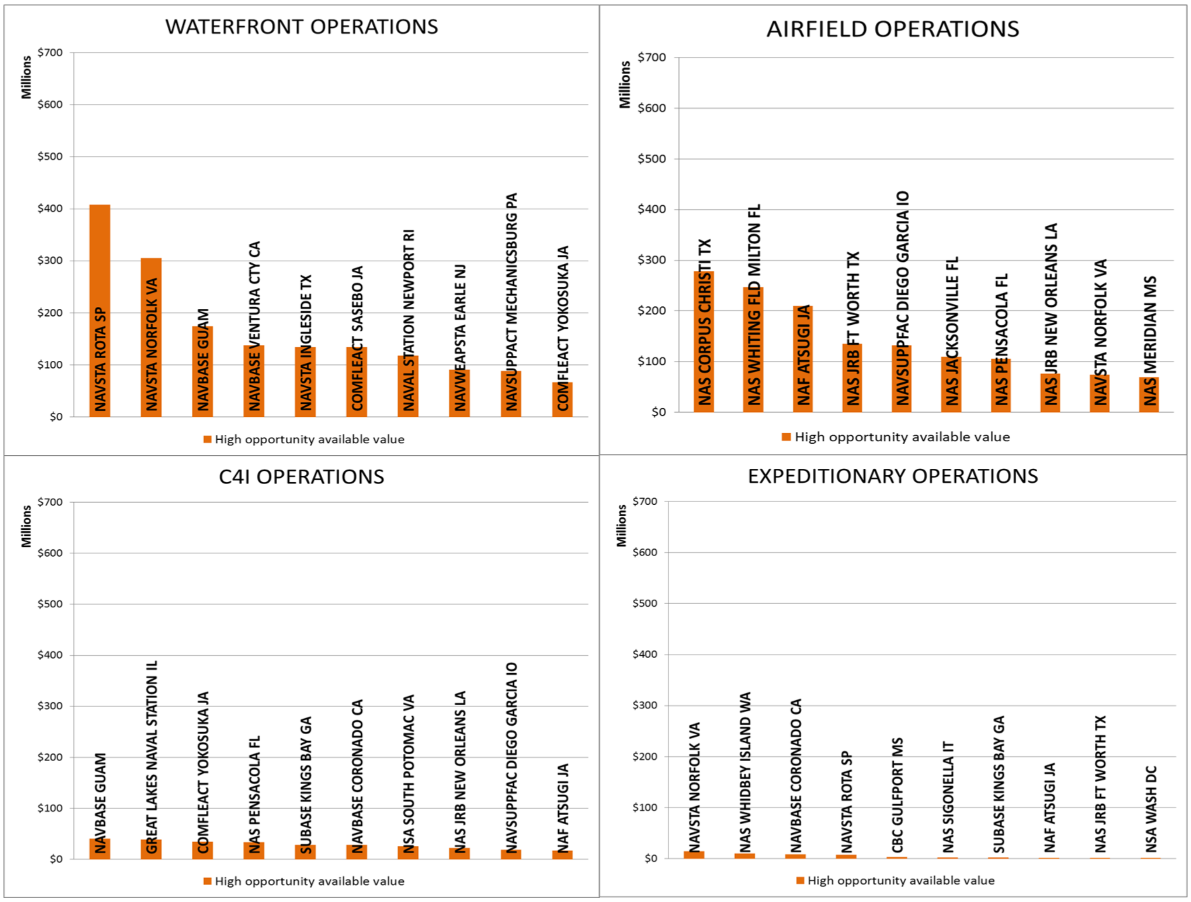


Figure 21. Installations with greatest opportunity for infrastructure reductions in fleet support

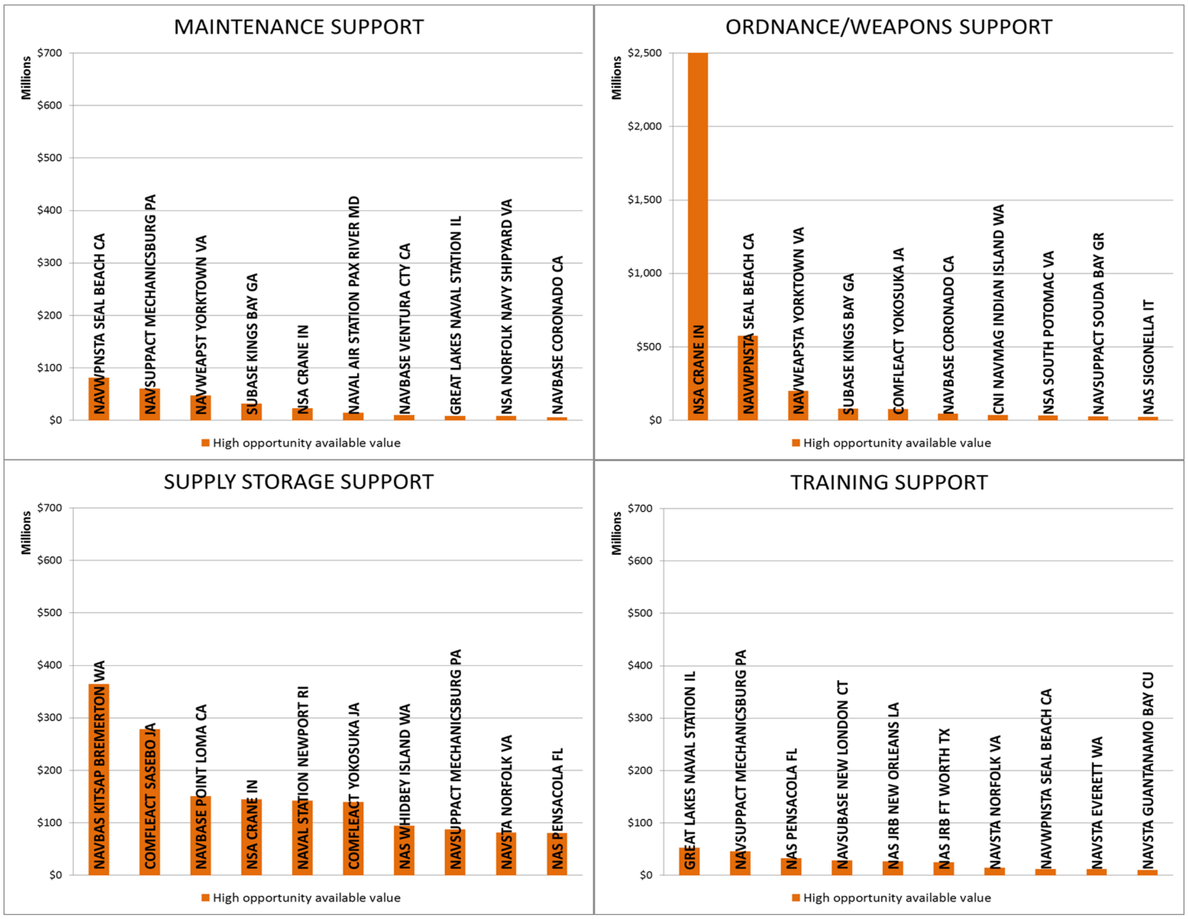
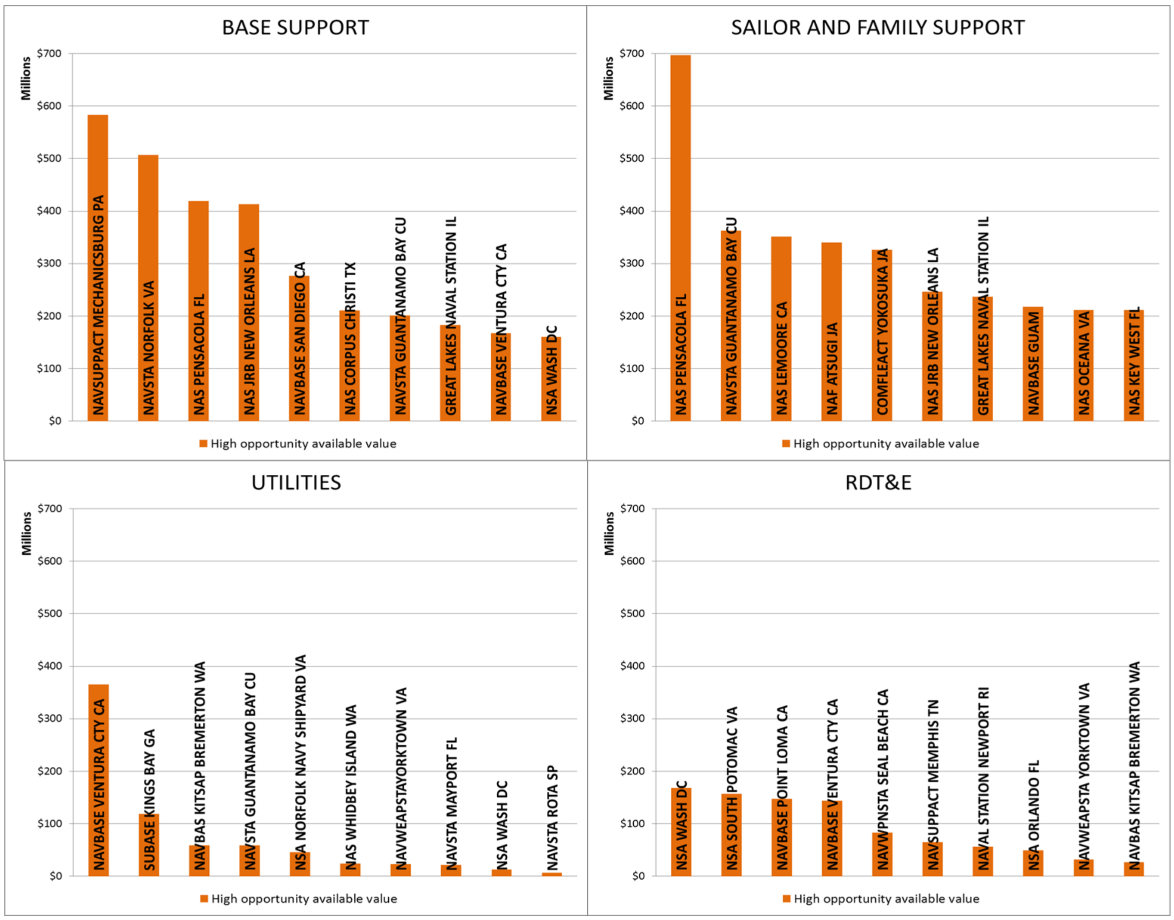


Figure 22. Installations with greatest opportunity for infrastructure reductions in shore support



Glossary

AC	Acres
BFR	Basic facility requirements
BL	Barrels
BRAC	Base realignment and closure
C5ISR	Command, control, communications, computers, combat systems, intelligence, surveillance, and reconnaissance
CCN	Category code number
CF	Cubic feet
CY	Cubic yards
CVN	Carrier, fixed wing aircraft, nuclear
EA	Each
DOD	Department of Defense
FB	Feet of berthing
FP	Firing point (firing ranges)
FRC	Fleet readiness center
FRP	Fleet response plan
FY	Fiscal year
GA	Gallons
GM	Gallons per minute

GOCO	Government-owned contractor-operated
HO	Holes (golf course)
iNFADS	Internet Navy Facility Asset Data Store
IO	Indian ocean
JSF	Joint strike fighter
KG	Thousand gallons per day
KV	Kilovolt-amperes, capacity unit of measure
KVA	Kilovolt-amperes
KW	Kilowatts
LCS	Littoral combat ship
LEED	Leadership in energy and environmental design
LF	Lineal feet
MB	British thermal units per hour
MDI	Mission dependency index
ME	Meters
MG	Millions of gallons
MI	Miles, statute
N814	OPNAV Warfighting Support Branch
NAS	Naval air station
NAVFAC	Naval Facilities Engineering Command
NSA	Naval support activity
NAVSTA	Naval station

NEPA	National environmental policy act
NMCI	Navy Marine Corps Intranet
NOC	Naval operations concept
NSI	Navy shore installations
NVR	Naval vessel register
NWCF	Navy working capital fund
OL	Outlets, number of
O&M,N/R	Operations and maintenance, Navy and Navy reserve
OPNAV	Office of the Chief of Naval Operations
OPS	Operations
OSD	Office of the Secretary of Defense
PB	Presidential budget
PEO	Program executive office
PH	Pounds per hour
POM	Program objective memorandum
PRV	Plant replacement value
R&D	Research and development
RDAT&E	Research, development, acquisition, testing, and evaluation
RDT&E	Research, development, testing, and evaluation
SCA	Shore capability area
SE	Seats
SECNAV	Office of the Secretary of the Navy

SF	Square feet
SFE	Square feet equivalent
SFPS	Shore facility planning system
SI	Sites
SNDL	Standard Navy distribution list
SP	Starting point
SSI	Strategic support index
ST	Sustainment
SY	Square yards
SYSCOM	System command
TFMMS	Total force manpower management system
TH	Tons per hour
TN	Tons, capacity
TR	Tons, refrigeration
UFC	Unified facilities criteria
UIC	Unit identification code
UM	Unit of measure
VFA	Fixed wing fighter attack

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